AERO-Dynamics HANDBOOK

NORTH AMERICAN AVIATION, INC.

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AERODYNAMICS HANDBOOK

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I FUNDAMENTAL RELATIONS AT ALTITUDE

A. The Standard Atmosphere

1. Basic Assumptions

The standard atmosphere adopted by the NACA up to 65,000 feet is based on the following assumptions:

a. The air is dry.

b. Air is a perfect gas with the gas constant

$R = 53.349$ ft/°F at 45° Lat.

$R = 96.029$ ft/°C at 45° Lat.

c. The acceleration due to gravity is 32.174 ft/sec^2, 45° lat., and is independent of altitude.

d. The pressure at sea level is 29.92" Hg.

e. The temperature at sea level is

$t_o = 59°F$ ($T_o = 518.7$ °R).

$t_o = 15°C$ ($T_o = 288.2$ °K).

f. Within the lower part of the atmosphere, the temperature of the air decreases linearly at the rate

$a = 0.003566$ °F/ft.

$a = 0.001981$ °C/ft.

A. The Standard Atmosphere-cont'd.

1. Basic Assumptions-cont'd

g. Above the altitude at which a temperature of -69.7°F (-56.5°C) is reached, the atmosphere is isothermal.

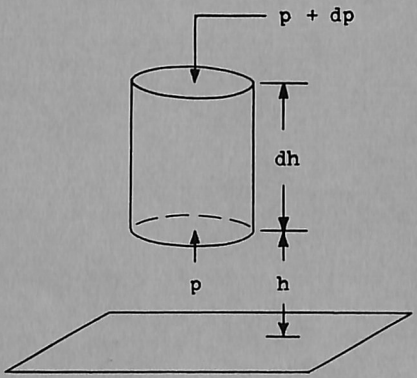
Assumption f yields the standard altitude - temperature relation below the isothermal level.

$$T = T_o - ah \qquad 1.$$

From equation 1, the isothermal level is seen to be 36,089 feet.

2. Physical Characteristics

Consider a body of air of unit cross-sectional area in equilibrium under the influence of gravity.



A. The Standard Atmosphere-cont'd.

2. Physical Characteristics-cont'd.

Summation of Vertical Forces

$$\Sigma F_y = 0 = p - (p+dp) - \gamma dh$$

where γ = specific weight = $g\rho$

$$dp = -g\rho\, dh \qquad 2.$$

Perfect Gas Law

$$p = Rg\,\rho\, T \qquad 3.$$

Therefore, below the isothermal level

$$\int_{p_o}^{p} \frac{dp}{p} = -\int_{o}^{h} \frac{dh}{R(T_o - ah)}$$

$$p = p_o \left(\frac{T}{T_o}\right)^{\frac{1}{aR}} \qquad 4.$$

Substituting for p and p_o in equation 4 gives

$$\rho = \rho_o \left(\frac{T}{T_o}\right)^{\frac{1}{aR} - 1} \qquad 5.$$

Substituting for T in equations 4 and 5, solving for h, and equating gives

A. The Standard Atmosphere - cont'd.

2. Physical Characteristics-cont'd.

$$\frac{\rho}{\rho_o} = \left(\frac{p}{p_o}\right)^{1 - aR} \qquad 6.$$

Under isothermal conditions (above 36,089 feet)

$$\frac{p}{p_1} = \frac{\rho}{\rho_1} = e^{-(h-h_1)/RT_1} \qquad 7.$$

where subscript 1 denotes conditions at the isothermal level.

Figures 1 and 2 show the properties of the standard atmosphere. The kinematic viscosity, ν, is a function of pressure and temperature.

B. Altitudes Other Than Standard

1. Pressure Altitude

In flight testing, standard atmospheric conditions are seldom encountered. It has therefore been necessary to define altitude in terms of actual pressures and densities.

Pressure altitude, h_p, is the altitude at which a given pressure is found in the standard atmosphere. It is the reading, corrected for instrument and static pressure errors, of a pressure type altimeter (see Section II B).

B. Altitudes Other Than Standard-cont'd.

2. Density Altitude

A second fictitious altitude, density altitude, h_d, is important in flight test data reduction. It is the height in the standard atmosphere at which a given density or density ratio is found.

3. Relations Between Altitudes

If pressure altitude and actual temperature are known, density altitude can be found from the equations for the standard atmosphere. A simpler method is to use the conversion chart shown in Figure 3. This chart is based on the perfect gas law, equation 3. It can be seen that in the standard atmosphere, $h_p = h_d = h$.

C. Density Factor

In reducing flight test data to standard conditions, the variation of observed density from standard density at a given pressure altitude must be taken into account. Figure 4 expresses observed density not as "density altitude" but as "density factor" where

$$F_d = \frac{\rho_{obs}}{\rho_{std}} = \frac{T_{std}}{T_{obs}} \qquad 8.$$

Standard conditions occur at a density factor of one.

D. Reynolds Number

1. Significance

The Reynolds number is a dimensionless criterion of the type of flow existing during relative motion between an ideal viscous fluid and a body immersed in it. It is the ratio between the force due to density (impact force) and the force due to viscosity. For Reynolds numbers below a definite "lower critical value", flow is laminar. Above a definite "higher critical value", turbulent flow exists. The intermediate values designate a transition region.

2. Derivation

Assume incompressible, adiabatic, steady flow of a homogeneous fluid. Then the only forces on a body in the fluid are impact force and viscous force. By dimensional analysis, it can be shown that

$$\text{impact force} = \psi_1 (\rho, v^2, l^2)$$

$$\text{viscous force} = \psi_2 (\mu, v, l)$$

Therefore,

$$RN = \frac{\rho v l}{\mu} = \frac{v l}{\nu} \qquad 9.$$

$\nu = \mu / \rho$

D. Reynolds Number-cont'd.

3. Application

a. At a constant Reynolds number, flow patterns are geometrically similar regardless of the numerical values of the component terms. Therefore, it is very desirable to conduct wind tunnel tests at a Reynolds number as near as possible to the expected full-scale value. Because the aerodynamic coefficients are functions of Reynolds number, "scale effect" corrections must be applied for variations between test and full-scale RN.

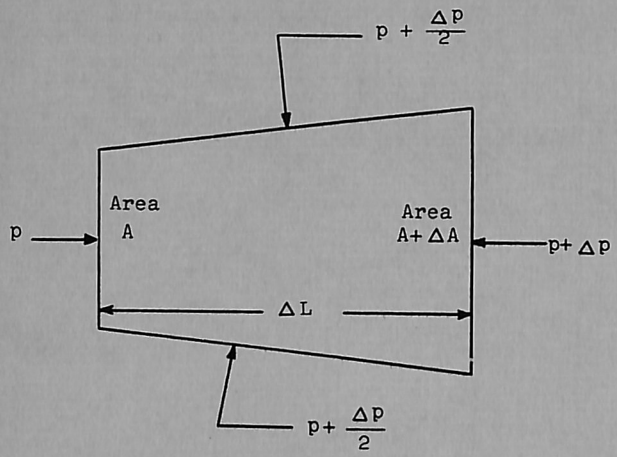
b. Unless compressibility effects are accounted for, wind tunnel tests at very high speed do not agree with tests at the same Reynolds number at a lower speed.

c. At any altitude in the standard atmosphere, ν is known (see figure 1). Thus Reynolds number may be plotted as a function of standard altitude and Vl as in figure 5. The actual value of a Reynolds number has no significance except in comparing a given series of geometrically similar forms. Therefore, the particular characteristic length dimension, l, that is chosen for any given form is arbitrary.

II AIRFLOW FUNDAMENTALS

A. Basic Considerations

Assume a small body of air undergoing a change such as in front of a pitot tube:



Resultant Force:

$$pA + (p + \frac{\Delta p}{2})\Delta A - (p+\Delta p)(A+\Delta A) = F$$

$$F = -A\Delta p$$

A. Basic Considerations-cont'd.

Mass Change per Unit Time:

$$m = \rho A \Delta L$$

where ρ = density, slugs per cu.ft. or $\frac{lb\text{-}sec^2}{ft^4}$

Conservation of Momentum:

$$F = m \frac{dV}{dt}$$

$$- Adp = \rho A \, dL \frac{dV}{dt}$$

$$\frac{dp}{\rho} + VdV = 0 \qquad 3.$$

Incompressible Flow:

$$\int \frac{dp}{\rho} + \int VdV = 0$$

$$p + \frac{1}{2} \rho V^2 = \text{Constant} \qquad 4.$$

A. Basic Considerations-cont'd.

Compressible Flow:

$$a = \text{speed of sound} = \left(\frac{kp}{\rho}\right)^{1/2}$$

where $k = 1.4011$ for air

$$p = C\rho^{k}$$

where C is a constant

$$dp = Ck\rho^{k-1}\, d\rho$$

Between two stations (1 and 2)

$$\int_1^2 Ck\rho^{k-2}\, d\rho + \int_1^2 VdV = 0$$

$$\frac{a_1^2}{k-1}\left[\left(\frac{p_2}{p_1}\right)^{\frac{k-1}{k}} - 1\right] + \frac{V_2^2 - V_1^2}{2} = 0 \qquad 5.$$

and

$$\frac{p_2}{p_1} = \left[1 - \left(\frac{k-1}{2}\right)\left(\frac{V_2^2 - V_1^2}{a_1^2}\right)\right]^{k/k-1} \qquad 6.$$

Let free stream conditions = subscript $0 \sim 1$

Let stagnation conditions = subscript $s \sim 2$

A. Basic Considerations-cont'd.

then $V_s = 0$ and:

$$\frac{p_s}{p_o} = \left[1 + \frac{k-1}{2} \frac{V_o^2}{a_o^2}\right]^{k/k-1} \qquad 7.$$

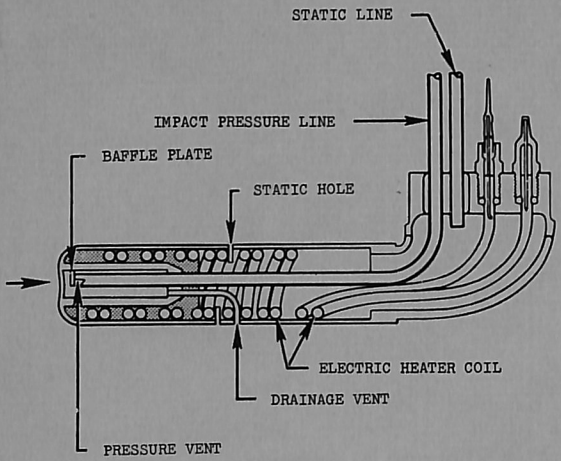
$$p_s = p_o + \frac{\rho_o V_o^2}{2} \left[1 + \frac{V_o^2}{4a_o^2} + \frac{V_o^4}{40a_o^4} + \cdots\right] \qquad 8.$$

where ρ_o = density, lb-sec^2/ft^4

B. Airspeed and Pressure Measurement Devices

1. Construction

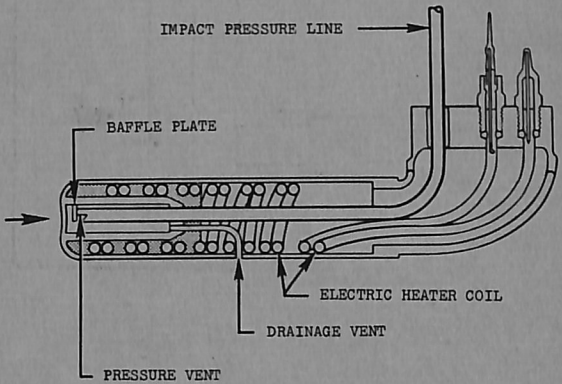
a. Pitot-Static Head

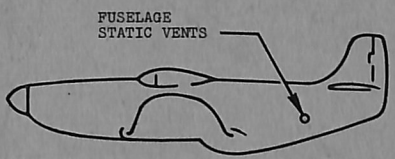


B. Airspeed and Pressure Measurement Devices-cont'd.

1. Construction-cont'd.

b. Pitot Head with Remote Static Source

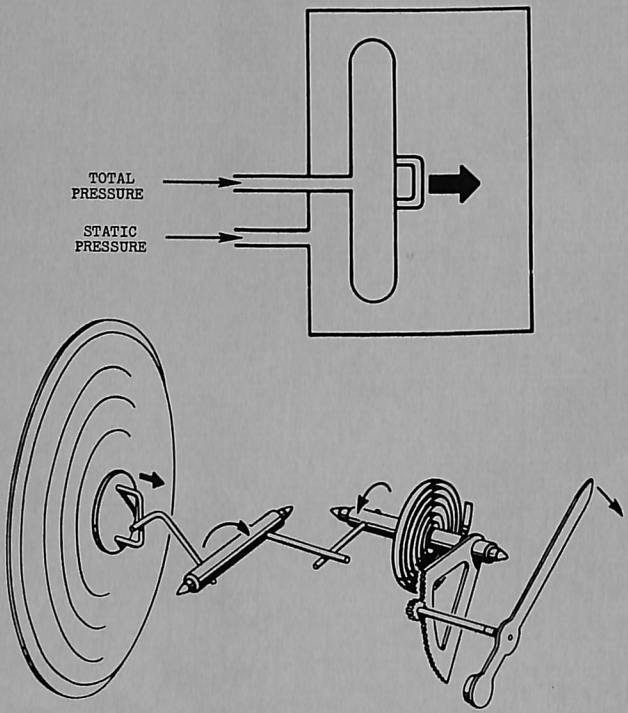




B. Airspeed and Pressure Measurement Devices-cont'd.

1. Construction-cont'd.

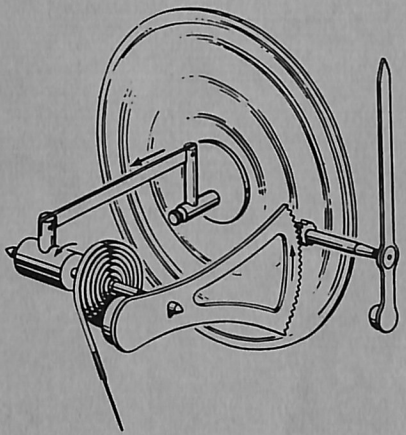
c. Airspeed Indicator

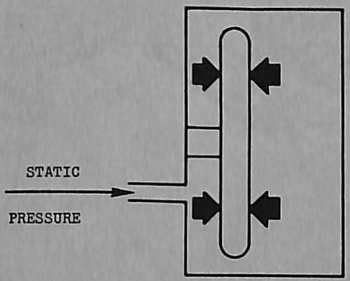


B. Airspeed and Pressure Measurement Devices-cont'd.

1. Construction-cont'd.

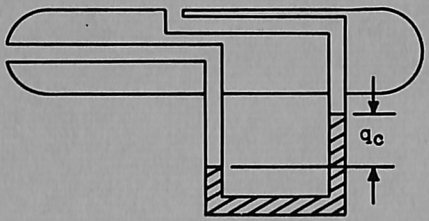
d. Altimeter





B. Airspeed and Pressure Measurement Devices- cont'd.

2. Impact Pressure



From equation 8,

$$q_c \text{ ("}H_2O, 59^\circ F) = V^2 \, 10^{-4} \left[4.919 + \frac{(V/100)^2}{47.16} \right.$$

V (IAS) in MPH

$$\left. + \frac{(V/1000)^4}{2.735} + \ldots \right] \qquad 9.$$

$$q_c \text{ ("}H_2O, 59^\circ F) = V^2 \, 10^{-4} \left[6.5223 + \frac{(V/100)^2}{26.820} \right.$$

V (IAS) in KNOTS

$$\left. + \frac{(V/1000)^4}{1.173} + \ldots \right]$$

Airspeed indicators are constructed so as to show the above relations at sea level between the indicator reading and applied pressure

B. Airspeed and Pressure Measurement Devices-cont'd.

2. Impact Pressure-cont'd.

differential. See figure 6 for values of these parameters.

3. Mach Number Relations

a. The Mach number, M, is a useful parameter, which is defined as follows:

$$M = \frac{V_T}{a} \qquad 10.$$

where a = speed of sound

V_T = true airspeed

$$a(\text{MPH}) = 33.44\ T^{1/2} \quad (^{\circ}F_{abs})$$
$$a(\text{MPH}) = 44.86\ T^{1/2} \quad (^{\circ}C_{abs})$$
$$a(\text{KNOTS}) = 29.04\ T^{1/2} \quad (^{\circ}F_{abs}) \qquad 11.$$
$$a(\text{KNOTS}) = 38.96\ T^{1/2} \quad (^{\circ}C_{abs})$$

Values of a are plotted on figure 7 as functions of temperature and standard altitude.

b. When the flow is brought to a standstill, a temperature increase results. This impact or adiabatic temperature rise is a function of true airspeed

B. Airspeed and Pressure Measurement Devices-cont'd.

3. Mach Number Relations-cont'd.

or Mach number and altitude, see figure 8.

$$\Delta t(^{o}F) = 1.794\ (V_T/100)^2 \quad \text{(MPH)}$$

$$\Delta t(^{o}C) = .997\ (V_T/100)^2 \quad \text{(MPH)}$$

$$\Delta t(^{o}F) = 2.379\ (V_T/100)^2 \quad \text{(KNOTS)}$$

$$\Delta t(^{o}C) = 1.322\ (V_T/100)^2 \quad \text{(KNOTS)}$$

12.

c. The relation of true airspeed and Mach number is shown by equation 10 and is seen to be a function of standard altitude (standard temperature lapse rate) on figure 9. This plot is convenient for showing the high speed or some critical speed of an airplane as a function of Mach number and altitude.

True impact pressure, q_c, and pressure altitude, h_p, are also related to Mach number by the following relation:

$$M = \left\{ \frac{2}{k-1} \left[\left(1 + \frac{q_c}{p} \right)^{\frac{k-1}{k}} - 1 \right] \right\}^{1/2} \qquad 13.$$

where p = pressure corresponding to pressure altitude, h_p.

B. Airspeed and Pressure Measurement Devices-cont'd.

3. Mach Number Relations-cont'd.

The above relation is used in the design of Mach meters which are built to show Mach number or to show the indicated airspeed corresponding to a chosen Mach number at any altitude. The relation of pressure altitude, equivalent airspeed (function of q_c), and Mach number is shown on figure 10.

Calibrated indicated airspeed is considered to be the airspeed read on the airspeed meter after it has been corrected for any deviations from equation 9, and for any position error (see section on calibrations). Since the indicator is constructed to follow equation 9, equivalent airspeed will agree with calibrated indicated airspeed only at sea level. At any other altitude, the speed of sound, (a in equation 8), will have a different value and the indicator will read differently from equivalent by the amounts shown on figure 11 as a function of calibrated indicated airspeed and altitude. The relationships of Mach number, calibrated indicated airspeed, and standard altitude are shown on figure 12.

d. In flight testing for performance, the true airspeed is of basic interest and is in turn related to equivalent airspeed and density as follows:

B. Airspeed and Pressure Measurement Devices-cont'd.

3. Mach Number Relations-cont'd.

$$V_T = V_e/\sigma^{1/2} \qquad 14.$$

where V_T = true airspeed

V_e = equivalent airspeed

σ = ratio of density at any altitude to density at sea level

True airspeed may be found by applying the increments of figure 11 to the calibrated indicated airspeed and dividing by the square root of the density ratio (function of density altitude corresponding to temperature and pressure altitude - see figure 3). A handier method is given on figures 13 and 14 for the respective cases of known free air temperatures and carburetor air temperatures (assumed to have full impact temperature rise).

4. Methods of Calibration

In obtaining the static pressure, the static orifices on the Pitot-static head or some other part of the airplane may be in a region where the pressure field does not correspond exactly to free stream conditions. This results in an error in both airspeed and altitude readings.

This static error may be determined by calibrating one airplane with another

B. Airspeed and Pressure Measurement Devices-cont'd.

4. Methods of Calibration-cont'd.

whose calibration is known or by flying past an object whose exact height is known. The difference in actual altimeter reading for each airspeed and what the altimeter should read (at the height at which the airplane goes by the object) is then converted to increments of airspeed by the following expression:

$$\frac{dV_i}{dh} = \frac{14.96(1-6.88 \times 10^{-6}h_p)^{4.256}}{V_M\,(1 + 3.45 \times 10^{-7}\,V_M^2)^{2.5}}$$

15.

$$\frac{dV_i}{dh} = \frac{11.28(1-6.88 \times 10^{-6}h_p)^{4.256}}{V_k\,(1 + 4.58 \times 10^{-7}\,V_k^2)^{2.5}}$$

where V_M = calibrated airspeed, CAS, in MPH

V_k = calibrated airspeed, CAS, in KNOTS

h_p(feet) = observed altimeter reading, corrected for instrument error only.

The error in altimeter reading at any altitude can be computed by the following relationship developed from the basic equations for pressure and altitude.

B. Airspeed and Pressure Measurement Devices - cont'd.

4. Methods of Calibration-cont'd.

$$\Delta p = -\sigma g \rho_o \Delta h_p \qquad 16.$$

where Δp = static pressure error

Δh_p = altimeter position error

ρ_o = standard sea level air density

σ = density ratio

$$\Delta h_p(\text{at altitude}) = \frac{\sigma \Delta h_p \text{ (at test altitude)}}{\sigma \text{ (at altitude)}} \qquad 17.$$

NOTE:

σ (at test altitude) = σ at actual height of airplane during tests.

C. Flow Over Bodies

1. Nomenclature

In wind tunnel testing, pressures are usually referenced to so-called incompressible dynamic pressure.

$$\frac{\Delta p}{q} = \frac{p \text{ (local)} - p \text{ (static)}}{q} \qquad 18.$$

C. Flow Over Bodies-cont'd.

1. Nomenclature-cont'd.

where p (local) = pressure at orifice

$$q = \frac{1}{2}\rho V_T^2$$

= lb/ft^2 for V_T in ft/sec

= $.002556\ V_T^2$ at sea level for V_T in MPH

= $.003390\ V_T^2$ at sea level for V_T in KNOTS

Also:

Assuming incompressible flow,

$p + q = \text{constant}$

$$\frac{p_1}{q} + \frac{\frac{1}{2}\rho_1 V_1^2}{q} = \frac{p_2}{q} + \frac{\frac{1}{2}\rho_2 V_2^2}{q}$$

let p_1 = p (local)

p_2 = static pressure of tunnel, also used as base of measurement of p (local)

V_2 = tunnel airspeed

V_1 = local airspeed over body

$\rho_1 = \rho_2$

C. Flow Over Bodies-cont'd.

1. Nomenclature-cont'd.

$$\frac{p(\text{local}) - p(\text{static})}{q} = \frac{V_2^2 - V_1^2}{V_2^2}$$

$$\frac{\Delta p}{q} = C_p = 1 - \left(\frac{V_1}{V_2}\right)^2 \qquad 20.$$

q (incompressible) is different from so-called compressible q (q_c of equation 9) by a factor, F_c, which is a function of Mach number, see figure 15. In high speed wind tunnel tests it is standard practice to use incompressible q to define the pressure ratio, $\Delta p/q$.

Another useful pressure ratio is p_1/H, where H = total head or stagnation pressure.

$$\frac{p_1}{H} = \frac{1 + \frac{k}{2} M^2 (\Delta p/q)}{1 + \frac{k}{2} M^2 F_c} \qquad 21.$$

This relation is shown on figure 16 with p_1/H, $\frac{p}{q}$, and M as the variables.

2. Variation of Critical Pressure Coefficients with Mach Number

Peak negative values of $\Delta p/q$ vary with Mach number in a more or less definite way. The latest popular variation is given on figure 17. Values of $\Delta p/q$ other than the peak vary in an indefinite manner. For a considerable range of Mach

C. Flow Over Bodies-cont'd.

2. Variation of Critical Pressure Coefficients with Mach Number-cont'd.

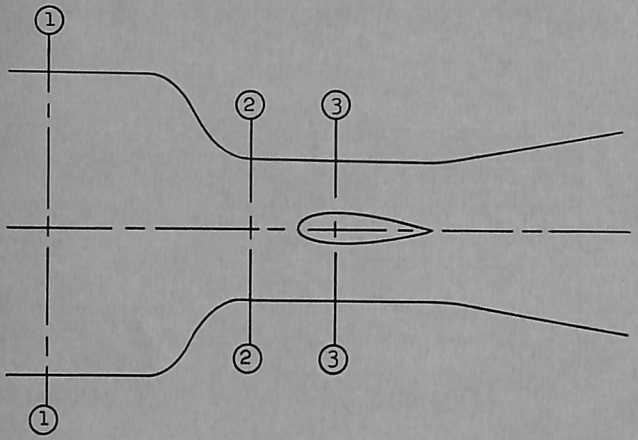
number, the p/H values forward of the peak negative $\Delta p/q$ tend to fall on one line.

3. Method for Evaluating the Effects of Contour Changes

Quite often the pressure distribution over a body is known and it is desired to either (a) determine the new pressure distribution for small changes in contour, or (b) determine the changes in contour required to give a new pressure distribution. Figure 18 shows a "standard bump" which can be added to or subtracted from a given contour with a fixed corresponding change in pressure. The figure also contains a pressure distribution curve for the bump. Multiplication of the curve ordinates by h/ℓ gives the various pressure coefficient changes associated with various amounts of bump height and length. The signs of $\Delta p/q$ shown reverse when the bump is "subtracted" from the contour. This figure gives the pressure increment due to a two-dimensional (ripple) bump with its axis perpendicular to the oncoming stream. If the axis of the bump is sweptback an angle Λ, multiply $\Delta p/q$ and M by cos Λ. The pressure increment due to a three-dimensional (blister) bump is approximately one half that shown on Figure 18.

D. Wind Tunnel Technique

1. Determination of Tunnel Operating Conditions.



So-called atmospheric wind tunnels (such as the North American Wind Tunnel) are vented to atmospheric pressure at the working section (station 3). Then from equation 6 and taking $\rho_1 A_1 V_1 = \rho_3 A_3 V_3$ and $\left(\frac{\rho_3}{\rho_1}\right)^k = \frac{p_3}{p_1}$:

D. Wind Tunnel Techniques-cont'd.

1. Determination of Tunnel Operating Conditions-cont'd.

$$V_3 = a_3 \left\{ \frac{2}{k-1} \left[\left(\frac{p_3}{p_1} \right)^{\frac{1-k}{k}} - 1 \right] \left[\frac{1}{1 - \left(\frac{p_3}{p_1} \right)^{2/k} \left(\frac{A_3}{A_1} \right)^2} \right] \right\}^{1/2} \qquad 22.$$

p_3 corresponds to atmospheric pressure

Since the presence of a model will affect the pressure readings at station 3, it is standard procedure to use pressures at stations 1 and 2 to determine the airspeed in the working section (which is still further checked by a calibration of the velocities over the expected model span at station 3).

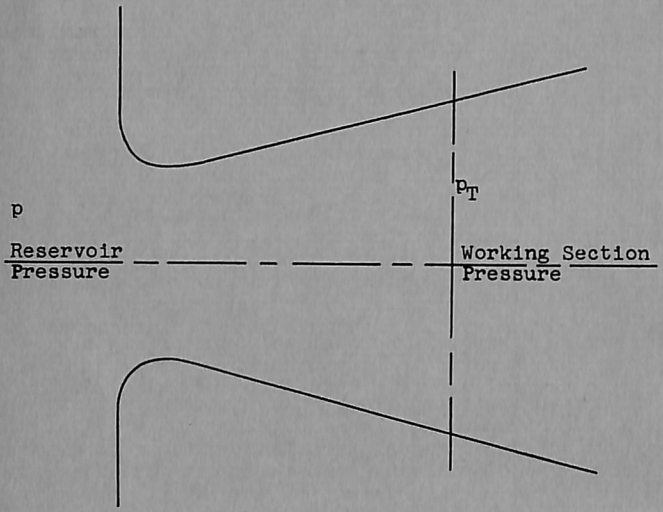
For low speed tunnels the density can be assumed constant, and equation 22 will be simplified. For high speed tunnels, equation 22 is applicable up to sonic speeds. For supersonic tunnels, a further modification is necessary. The working section of a supersonic tunnel is at an area downstream from and larger than the minimum cross-sectional area. This results from the equation for continuity of flow from which it can be shown that

$$\frac{dA}{dV} = \frac{A}{V} (M^2 - 1) \qquad 23.$$

D. Wind Tunnel Technique-cont'd.

1. Determination of Tunnel Operating Conditions-cont'd.

and that for M greater than 1.0, dA/dV must be positive. The Mach number M is established by the pressure ratio p_T/p



D. Wind Tunnel Technique-cont'd.

1. Determination of Tunnel Operating Conditions-cont'd.

$$\left(\frac{p_T}{p}\right)^{\frac{k-1}{k}} = 1 + \frac{k-1}{2} M^2 \qquad 24.$$

Setting M = 1.0 and using k = 1.4, gives $\frac{p}{p_T} = 0.528$ (throat). At this ratio of p/p_T the flow through the tube is a maximum, and experimentally for any value of $p/p_T \leq 0.528$, the flow through a nozzle connected to a reservoir will give M = 1.0 at the throat.

2. Choking Mach Number

With models present in subsonic wind tunnels, it becomes impossible to exceed a certain Mach number in the closed working section. This particular Mach number is called the choking Mach number and is illustrated by the following equation 25 (figure 19), which has been reliably checked by tests.

$$\frac{A_m}{A_t} = 1 - \frac{M_{ch}}{\left(1 + \frac{M_{ch}^2 - 1}{6}\right)^3} \qquad 25.$$

where M_{ch} = choking Mach number

A_m = model frontal area

A_t = test section cross-sectional area

D. Wind Tunnel Technique-cont'd.

2. Choking Mach Number-cont'd.

Data obtained approximately 0.01 in Mach number below the choking Mach number may be fairly well corrected by the relation of equations 26 and 27.

$$\Delta M = M_o \left(1 + 0.2\, M_o^2\right) \frac{\Delta V}{V_o} \qquad 26.$$

where M_o = stream Mach number

$$\frac{\Delta V}{V_o} = \frac{1}{\beta^3}\left[\frac{\pi^2}{12}\,\lambda\left(\frac{t}{h}\right)^2 + \eta\,\frac{t}{h}\right] \qquad 27.$$

where $\beta = \left(1 - M_o^2\right)^{1/2}$

λ = factor dependent upon shape of the body = 4 for NACA 0012 airfoil

η = empirical factor for effect of wake upon the stream = 0.059 for NACA 0012 airfoil

t = profile thickness of body

h = mean height of tunnel (tunnel area/model span)

III STANDARD NOTATION

A. General and Applied Aerodynamics

a	ft/sec, MPH, KN	velocity of sound in air
a	ft/sec^2	linear acceleration
a	°F/ft, °C/ft	temperature gradient in standard atmosphere
a	per degree	slope of lift curve
a_o	per degree	slope of lift curve at infinite aspect ratio
ac		aerodynamic center
A	in^2, ft^2	cross-sectional area; surface area
AR		aspect ratio
b	inches, feet	width; span
c	inches, feet	chord length
$\bar{c}$	inches, feet	mean aerodynamic chord
$\bar{c}_{aft}$	inches, feet	mean aerodynamic chord of movable surface aft of hinge line

A. General and Applied Aerodynamics - cont'd.

c_p	BTU/°F/lb	specific heat at constant pressure
c_v	BTU/°F/lb	specific heat at constant volume
C_D		total drag coefficient
C_{D_F}		skin friction drag coefficient
C_{D_i}		induced drag coefficient
C_{D_o}		profile drag coefficient (two-dimensional flow)
C_{D_p}		parasite drag coefficient
C_{D_π}		proper drag coefficient of airplane component
C_h		hinge moment coefficient
C_L		lift coefficient
C_l		rolling moment coefficient
C_m		pitching moment coefficient
C_n		yawing moment coefficient

A. General and Applied Aerodynamics - cont'd.

C_p		pressure coefficient
C_X		longitudinal force coefficient
C_Y		lateral or side force coefficient
C_Z		normal force coefficient
CAS	MPH, KN	calibrated indicated airspeed-IAS_{H_2O}, corrected for position error
CAT	°F, °C	carburetor air temperature
cg		center of gravity
cp		center of pressure
D	in, ft.	diameter
D	pounds	total drag
D_i	pounds	induced drag
D_o	pounds	profile drag (two-dimensional flow)
D_p	pounds	parasite drag
e		efficiency
e		airplane efficiency factor
e		base of Napierian logarithms

A. General and Applied Aerodynamics - cont'd.

E		weight ratio
EAS	MPH, KN	equivalent airspeed
f	in^2, ft^2	flat plate area equivalent to parasite drag
F	pounds	force
F_c		compressibility factor
F_d		density factor
g	ft/sec^2	acceleration due to gravity
h	feet	altitude; height
h_d	feet	density altitude
h_p	feet	pressure altitude
h_t	feet	temperature altitude
H	lb/in^2, lb/ft^2 $"H_2O$, $"H_g$	total pressure head; absolute impact pressure
HM	ft-lb.	hinge moment
i	degrees	angle of incidence
I	$slug\text{-}ft^2$ or $lb\text{-}ft\text{-}sec^2$	moment of inertia

A. General and Applied Aerodynamics - cont'd.

IAS	MPH, KN	indicated airspeed, generally instrument reading
IAS_{H_2O}	MPH, KN	instrument reading corrected for instrument error
k	inches, feet	radius of gyration
k		ratio of c_p to c_v
l, L, ℓ	inches, feet	length
L	pounds	lift
ℓ	ft-lb	rolling moment (about X axis)
m	slugs or $lb\text{-}sec^2/ft$	mass
m	ft-lb	pitching moment (about Y axis)
M	ft-lb	moment
M		Mach number
MAC	inches, feet	mean aerodynamic chord
n	ft-lb	yawing moment (about Z axis)
n	g	load factor

A. General and Applied Aerodynamics - cont'd.

n	rev/sec	rotational speed
N	rev/min	rotational speed
OAT	°F, °C	outside air temperature
p	radians/sec	angular velocity in roll
p	lb/in^2, lb/ft^2, $"H_2O$, $"H_g$	pressure
Δp	lb/in^2, lb/ft^2	local static pressure minus free stream static pressure
p_T	lb/in^2, lb/ft^2 $"H_2O$, $"H_g$	total pressure head; absolute impact pressure
q	radians/sec	angular velocity in pitch
q	lb/ft^2, $"H_2O$, $"H_g$	incompressible dynamic pressure
q_c	lb/ft^2, $"H_2O$, $"H_g$	impact pressure or compressible q
Q	ft-lb	resultant moment

A. General and Applied Aerodynamics - cont'd.

r	radians/sec	angular velocity in yaw
r	mi/gal, mi/lb	specific range
r	inches, feet	radius
R	pounds	resultant force
R	pounds	resistance
R	ft/°F, ft/°C	universal gas constant
R/C	ft/min	rate of climb
R/D	ft/min	rate of descent
RN, R		Reynolds number
S	in^2, ft^2	surface area, especially projected wing area
S_{aft}	in^2, ft^2	area of movable surface aft of hinge line
S_{π}	in^2, ft^2	proper area of model components - projected frontal area for nonlifting components
t	inches, feet	thickness
t	sec, min, hr	time

A. General and Applied Aerodynamics - cont'd.

t	°F, °C	temperature
T	$°F_{abs}$ or °R, $°C_{abs}$ or °K	absolute temperature
TAS	MPH, KN	true airspeed
u	ft/sec	longitudinal component of velocity
v	ft/sec	lateral (sideslipping) component of velocity
v	ft^3/lb	specific volume
V	ft^3	volume
V	ft/sec, ft/min, MPH, KN	velocity
V_c	MPH, KN	true airspeed in climb
V_e	MPH, KN	equivalent airspeed-CAS, corrected for compressibility error
V_i	MPH, KN	indicated airspeed
V_S	MPH, KN	stalling airspeed
V_T	MPH, KN	true airspeed
w	ft/sec	normal component of velocity

A. General and Applied Aerodynamics - cont'd.

W	pounds	weight
x	inches, % $\bar{c}$	horizontal location of center of moments from leading edge of MAC
x	feet	displacement along X axis (longitudinal displacement)
X	pounds	force along X axis (longitudinal force)
X		longitudinal axis
y	inches, % $\bar{c}$	vertical location of center of moments from leading edge of MAC
y	feet	displacement along Y axis (lateral displacement)
Y	pounds	force along Y axis (lateral or side force)
Y		lateral axis
z	feet	displacement along Z axis (normal displacement)

A. General and Applied Aerodynamics - cont'd.

Z	pounds	force along Z axis (normal force)
Z		normal axis
α	degrees	angle of attack of reference line
α_o	degrees	angle of attack at zero lift
γ		ratio of c_p to c_v; weight ratio
γ	lb/ft^3	specific weight
γ	degrees	flight path angle; glide angle
Γ	degrees	dihedral angle
Γ	ft^2/sec	circulation
δ	degrees	deflection of a movable surface
δ		pressure ratio
Δ		any increment
ϵ		weight ratio
ϵ	degrees	angle of downwash
θ	degrees	angle of pitch
θ		temperature ratio
λ_p		parasite loading

A. General and Applied Aerodynamics - cont'd.

λ_s		span loading
λ_t		thrust power loading
μ		coefficient of friction
μ	slugs/ft-sec or lb-sec/ft^2	absolute viscosity
ν	ft^2/sec	kinematic viscosity
ρ	slugs/ft^3 or lb-sec^2/ft^4	density
σ		relative density, particularly with respect to standard sea level density
ϕ	degrees	angle of roll or bank
ψ	degrees	angle of yaw
ψ		stream function
ω	radians/sec	angular velocity

B. Engines and Propellers

AF		activity factor
ASHP	horsepower	auxiliary stage horsepower
b	inches	chord of propeller blade section
BHP	horsepower	brake horsepower

A. General and Applied Aerodynamics - cont'd.

λ_s		span loading
λ_t		thrust power loading
μ		coefficient of friction
μ	slugs/ft-sec or lb-sec/ft^2	absolute viscosity
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B. Engines and Propellers

AF		activity factor
ASHP	horsepower	auxiliary stage horsepower
b	inches	chord of propeller blade section
BHP	horsepower	brake horsepower

B. Engines and Propellers - cont'd.

IHP	horsepower	indicated horsepower
J		advance ratio
MAP, MP	"Hg	manifold absolute pressure
n	rev/sec	propeller rotational speed
N	rev/min	propeller rotational speed
p	feet	pitch of propeller
P	ft-lb/sec	power
Q	pounds, gallons	fuel quantity
Q	lb-ft	torque
Q_c		torque coefficient
r	feet	radius of any blade element of propeller
R	feet	propeller radius
RPM	rev/min	engine rotational speed

B. Engines and Propellers - cont'd.

T_c		thrust coefficient, based on propeller diameter
THP	horsepower	thrust horsepower
TSFC	lb/lb thrust/hr	thrust specific fuel consumption
V'	ft/sec	inflow velocity
V_s	ft/sec	slipstream velocity
W_a	lb/hr	air flow
W_f	lb/hr	fuel flow
Z		number of operating propellers
α	degrees	angle of attack of propeller blade section
β	degrees	blade angle
η		propulsive efficiency
σ		propeller solidity
ϕ	degrees	effective helix angle - acute angle between plane of rotation of propeller and resultant velocity vector

C. Subscripts

a	aileron
A	available
b	balance
c	compressible conditions; corrected value
corr	corrected value
cr	critical
D	dorsal
e	engine; elevator; equivalent
eff	effective
f	fin; flap; final value
F	fuselage
H	horizontal tail
i	induced; initial; indicated; isothermal
inc	incompressible conditions

C. Subscripts - cont'd.

j	jet
m	mean
M	Mach or high speed effect
max	maximum value
min	minimum value
N	nacelle
o	standard; sea level; initial; observed; flight test data
opt	optimum value
p	projected; propeller
r	rudder
R	required
s	stabilizer; static
S	standard
sl	slat
SL	standard sea level condition

C. Subscripts - cont'd.

t	tail; tab; terminal
T	true; total
u	uncorrected
V	vertical tail
w	wing; wind; wind axes
W	weight

IV BASIC EQUATIONS

A. NACA Standard Atmosphere

$t = t_o - ah$ (below isothermal level)

$$\frac{p}{p_o} = \left(1-0.006875\frac{h}{1000}\right)^{5.256}$$ (below isothermal level)

$$\frac{\rho}{\rho_o} = \left(1-0.006875\frac{h}{1000}\right)^{4.256}$$ (below isothermal level)

$$\frac{\rho}{\rho_o} = \left(\frac{p}{p_o}\right)^{0.8097}$$ (below isothermal level)

$$\frac{p}{p_i} = \frac{\rho}{\rho_i} = e^{-0.00004806(h-h_i)}$$ (above isothermal level)

B. General Properties of Air

$p = Rg\rho T$ or $\frac{p}{p_o} = \frac{\rho}{\rho_o}\frac{T}{T_o}$

$$\frac{p}{p_o} = \left(\frac{\rho}{\rho_o}\right)^k = \left(\frac{v_o}{v}\right)^k$$ (for adiabatic change)

B. General Properties of Air-cont'd.

$$\frac{T}{T_o} = \left(\frac{p}{p_o}\right)^{\frac{k-1}{k}} = \left(\frac{v_o}{v}\right)^{k-1}$$ (for adiabatic change)

$$\frac{\rho}{\rho_o} = \left(\frac{T}{T_o}\right)^{\frac{1}{k-1}}$$ (for adiabatic change)

$\gamma = 1.326 \frac{p}{T}$ = lb/ft^3 for p in "Hg at 32°F and standard gravity

$\rho = 0.04120 \frac{p}{T}$ = slugs/ft^3 for p in "Hg at 32°F and standard gravity

$\sigma = 17.34 \frac{p}{T}$ for p in "Hg at 32°F and standard gravity

$°F = 9/5\ °C + 32$

C. Air Flow

$$\frac{dp}{\rho} + VdV = 0$$ (general form of Bernoulli's equation)

$$p + 1/2\,\rho V^2 = H = \text{constant}$$

(incompressible flow)

C. Air Flow-cont'd.

$$\frac{p_2}{p_1} = \left[1 - \left(\frac{k-1}{2}\right)\left(\frac{V_2^2 - V_1^2}{a_1^2}\right)\right]^{\frac{k}{k-1}}$$

(compressible flow)

$q = 1/2\,\rho V^2 = lb/ft^2$ for V in ft/sec

$$q(lb/ft^2) = 1.076\ \rho\ V_T^2 = \frac{\sigma V_T^2}{391} \qquad \text{TAS in MPH}$$

$$q(lb/ft^2) = 1.426\ \rho\ V_T^2 = \frac{\sigma V_T^2}{295} \qquad \text{TAS in KNOTS}$$

$q_c = qF_c$

$$F_c = 1 + \frac{M^2}{4} + \frac{M^4}{40} + \frac{M^6}{1600} + \ \ldots .$$

$$\Delta t(^oF) = 1.794\left(\frac{V_T}{100}\right)^2 \qquad \text{TAS in MPH}$$

$$\Delta t(^oC) = .997\left(\frac{V_T}{100}\right)^2 \qquad \text{TAS in MPH}$$

$$\Delta t(^oF) = 2.379\left(\frac{V_T}{100}\right)^2 \qquad \text{TAS in KNOTS}$$

$$\Delta t(^oC) = 1.322\left(\frac{V_T}{100}\right)^2 \qquad \text{TAS in KNOTS}$$

(temperature rise due to adiabatic compression)

D. General and Applied Aerodynamics

$$AR = b^2/S$$

$$a = \left(\frac{kp}{\rho}\right)^{1/2} = \text{ft/sec for p in lb/ft}^2$$

$$C_D = \frac{D}{qS}$$

$$C_{D_i} = \frac{C_L^2}{\pi AR} \qquad \text{(assuming elliptical lift distribution)}$$

$$C_{D_P} = C_D - C_{D_i}$$

$$C_h = \frac{HM}{q\int c^2 dy} = \frac{HM}{qS_{aft}\bar{c}_{aft}}$$

$$C_L = \frac{L}{qS}$$

$$C_\ell = \frac{\ell}{qbS}$$

$$C_m = \frac{m}{qcS}$$

$$C_n = \frac{n}{qbS}$$

$$C_p = \frac{p(\text{local}) - p(\text{static})}{q} = \frac{\Delta p}{q}$$

D. General and Applied Aerodynamics-cont'd.

$$C_X = \frac{X}{qS}$$

$$C_Y = \frac{Y}{qS}$$

$$C_Z = \frac{Z}{qS}$$

$$f = D_P/q = C_{D_P}S$$

$$F_d = \sigma_{obs}/\sigma_{std} = \rho_{obs}/\rho_{std} = T_{std}/T_{obs}$$

$$M = V_T/a$$

$$R/C(ft/min) = \frac{33000\,\Delta THP}{W\left(1+.0669V_T\frac{dV_T}{dh}\right)} \qquad V_T \text{ in MPH}$$

$$R/C(ft/min) = \frac{33000\,\Delta THP}{W\left(1+.0887V_T\frac{dV_T}{dh}\right)} \qquad V_T \text{ in KNOTS}$$

$$R/C(ft/min) = \frac{88\,V_T\,\Delta F}{W\left(1+.0669V_T\frac{dV_T}{dh}\right)} \qquad V_T \text{ in MPH}$$

E. Engines and Propellers

$$C_P = \frac{P}{\rho n^3 D^5} = \frac{10^{11} BHP}{2.002\ N^3 D^5 \sigma} = 2\pi C_Q$$

$$C_Q = \frac{Q}{\rho n^2 D^5} = \frac{10^7 Q}{6.606\ N^2 D^5 \sigma}$$

$$C_S = \left(\frac{\rho V^5}{P n^2}\right)^{1/5} = \frac{J}{C_P^{1/5}}$$

$$C_S = \frac{0.6379\ V_T\ \sigma^{1/5}}{BHP^{1/5}\ N^{2/5}} \qquad V_T \text{ - MPH}$$

$$C_S = \frac{0.7346\ V_T\ \sigma^{1/5}}{BHP^{1/5}\ N^{2/5}} \qquad V_T \text{ - KNOTS}$$

$$C_T = \frac{F}{\rho n^2 D^4} \quad \frac{10^7\ F}{6.606\ N^2 D^4 \sigma}$$

$$F = \frac{375\ THP}{V_T} \qquad V_T \text{ - MPH}$$

$$F = \frac{325.5\ THP}{V_T} \qquad V_T \text{ - KNOTS}$$

$$F = K_c\ F i_W \left(\frac{W}{W_S}\right)$$

D. General and Applied Aerodynamics-cont'd.

$$R/C(ft/min) = \frac{101.3 V_T \Delta F}{W\left(1+.0887 V_T \frac{dV_T}{dh}\right)} \qquad V_T \text{ in KNOTS}$$

$$RN = \frac{\rho V l}{\mu} = \frac{V l}{\nu}$$

$$V_e = EAS = V_T \sigma^{1/2}$$

$$V_e(MPH) = \left(\frac{391W}{SC_L}\right)^{1/2} = 19.77q^{1/2}$$

$$V_e(KNOTS) = \left(\frac{295W}{SC_L}\right)^{1/2} = 17.18q^{1/2}$$

$$V_{i_W} = \frac{V_e}{(W/W_S)^{1/2}}$$

$$\lambda_p = \frac{2W}{f \rho_o}$$

$$\lambda_s = \frac{2W}{\pi b_e^2 \rho_o}$$

$$\lambda_t = \frac{W_o}{550 P_o \eta_o}$$

$$\nu = \mu/\rho$$

E. Engines and Propellers-cont'd.

$$F_{TS} = \frac{\eta \text{ with tip-speed loss}}{\eta \text{ without tip-speed loss}}$$

$$IHP = BHP + FHP$$

$$J = \frac{88V_T}{ND} \qquad V_T \text{ - MPH}$$

$$J = \frac{101.3V_T}{ND} \qquad V_T \text{ - KNOTS}$$

$$K_c = \frac{K_u{}^4 + K_M}{1 + K_u{}^4}$$

$$K_M = \frac{C_{DP_M}}{C_{DP_O}}$$

$$K_u = \frac{V_{i_{W_O}}}{V_{i_W}} \qquad \text{(where subscript zero} \approx \text{maximum L/D values)}$$

$$Q_c = \frac{C_Q}{J^2} = \frac{Q}{\rho V^2 D^3}$$

$$T_c = \frac{C_T}{J^2} = \frac{F}{\rho V^2 D^2}$$

E. Engines and Propellers-cont'd.

$$T_c = \frac{10^3 F}{5.115 V_T^2 D^2 \sigma} \qquad V_T \text{ - MPH}$$

$$T_c = \frac{10^3 F}{6.783 V_T^2 D^2 \sigma} \qquad V_T \text{ - KNOTS}$$

$$THP = \frac{K_c THP i_W}{\sigma^{1/2}} \left(\frac{W}{W_S}\right)^{3/2}$$

$$THP = BHP\,\eta$$

$$THP_R = \frac{C_D S V_T^3 \sigma}{146600} \qquad V_T \text{ - MPH}$$

$$THP_R = \frac{C_D S V_T^3 \sigma}{96000} \qquad V_T \text{ - KNOTS}$$

$$\alpha = \beta - \phi$$

$$\eta = \frac{C_T}{C_P} J$$

$$\phi = \tan^{-1} \frac{V}{2\pi rn} = \tan^{-1} \frac{J}{\pi}$$

V PHYSICAL CONSTANTS

a		0.003566 0.001981	°F/ft °C/ft
a_o		1117	ft/sec
g_o		32.17405	ft/sec^2
h_1	isothermal level	36,089	feet
k	air	1.4011	
p_o		29.9213 2116.22 14.6960	"Hg lb/ft^2 lb/in^2
R	(air, 45° latitude)	53.3492 96.0286	ft/°F ft/°C
t_1	isothermal temperature	-69.7 -55.6	°F °C
t_o		59 15	°F °C

V PHYSICAL CONSTANTS-cont'd.

T_o	518.69 288.16	^oF abs or ^oR ^oC abs or ^oK
absolute zero	-459.69 -273.16	^oF ^oC
γ_o (water)	62.3721	lb/ft^3
γ_o (mercury)	846.409	lb/ft^3
γ (mercury at 32°F - 0°C and standard pressure)	848.719	lb/ft^3
γ_o (air)	0.07648	lb/ft^3
μ_o (air)	3.745×10^{-7}	slugs/ft-sec or $lb\text{-}sec/ft^2$
ν_o (air)	1.576×10^{-4}	ft^2/sec
ρ_o (air)	0.002377	$slugs/ft^3$ or $lb\text{-}sec^2/ft^4$

VI CONVERSION TABLE

Columns of mercury at 32°F (0°C) and standard sea level gravity.
Columns of water at 59°F (15°C) and standard sea level gravity.

Multiply	By	To Obtain
Atmospheres	33.9291	Feet of water
	29.9213	Inches of mercury
	407.149	Inches of water
	1013.25	Millibars
	2116.22	Pounds per sq. ft.
	14.6960	Pounds per sq. in.
Cubic feet	7.48052	Gallons (U. S.)
Degrees (angle)	0.0174533	Radians
Feet of water	0.0294732	Atmospheres
	0.881876	Inches of mercury
	29.89	Millibars
	62.3721	Pounds per sq. ft.
	0.433140	Pounds per sq. in.
Feet per minute	0.0166667	Feet per second
	0.00986810	Knots
	0.0113636	Miles per hour
Feet per second	0.592086	Knots
	0.681818	Miles per hour

VI CONVERSION TABLE-cont'd.

Multiply	By	To Obtain
Gallons (U. S.)	0.133681	Cubic feet
	231.	Cubic inches
Gallons per minute	0.00222801	Cubic feet per second
Horsepower	33000.	Foot-pounds per minute
	550.	Foot-pounds per second
Inches of mercury	0.0334210	Atmospheres
	1.13395	Feet of water
	13.6074	Inches of water
	33.8639	Millibars
	70.7266	Pounds per sq. ft.
	0.491157	Pounds per sq. in.
Inches of water	0.00245610	Atmospheres
	0.0734897	Inches of mercury
	2.49082	Millibars
	5.19768	Pounds per sq. ft.
	0.0360950	Pounds per sq. in.
Knots	1.68894	Feet per second
	1.15155	Miles per hour
	101.33640	Feet per minute

VI CONVERSION TABLE-cont'd.

Multiply	By	To Obtain
Knots squared	2.85252	(Feet per second) squared
Miles	5280.	Feet
	0.868392	Nautical miles
Miles per hour	88.	Feet per minute
	1.46667	Feet per second
	0.868392	Knots
Miles per hour squared	2.15111	(Feet per second) squared
Millibars	0.00098692	Atmospheres
	0.03346	Feet of water
	0.029530	Inches of mercury
	0.40148	Inches of water
	2.0886	Pounds per sq. ft.
	0.014504	Pounds per sq. in.
Nautical miles	6080.20	Feet
	1.15155	Miles

VI CONVERSION TABLE-cont'd.

Multiply	By	To Obtain
Pounds per square foot	0.000472541	Atmospheres
	0.0160328	Feet of water
	0.0141389	Inches of mercury
	0.192394	Inches of water
	0.47880	Millibars
	0.00694444	Pounds per sq. in.
Pounds per square inch	0.0680457	Atmospheres
	2.30872	Feet of water
	2.03601	Inches of mercury
	27.7047	Inches of water
	68.947	Millibars
Radians	57.2958	Degrees (angle)
Radians per second	9.54930	Revolutions per minute
	0.159155	Revolutions per second
Revolutions	6.28318	Radians
Revolutions per minute	0.104720	Radians per second
Slugs	32.1740	Pounds

A. Properties of the I.C.A.O. Standard Atmosphere

h feet	Temperature °F abs	Temperature °C abs	p in. Hg	$\rho \times 10^4$ slugs/ft^3	$\nu \times 10^4$ ft^2/sec	P/P_o	σ	$\sigma^{\frac{1}{2}}$	q/M^2	Knots a	Knots $a\sigma^{\frac{1}{2}}$
0	518.7	288.2	29.92	23.77	1.576	1.0000	1.0000	1.0000	1483	661.3	661.3
1,000	515.1	286.2	28.86	23.08	1.614	.9644	.9711	.9854	1430	659.0	649.4
2,000	511.6	284.2	27.82	22.41	1.653	.9298	.9428	.9710	1379	656.7	637.7
3,000	508.0	282.2	26.82	21.75	1.694	.8962	.9151	.9566	1329	654.4	626.0
4,000	504.4	280.2	25.84	21.11	1.735	.8637	.8881	.9424	1280	652.1	614.5
5,000	500.9	278.3	24.90	20.48	1.778	.8320	.8617	.9282	1234	649.8	603.1
6,000	497.3	276.3	23.98	19.87	1.823	.8014	.8359	.9142	1188	647.5	591.9
7,000	493.7	274.3	23.09	19.27	1.869	.7716	.8106	.9003	1144	645.2	580.9
8,000	490.2	272.3	22.22	18.68	1.916	.7428	.7860	.8866	1101	642.9	570.0
9,000	486.6	270.3	21.39	18.11	1.965	.7148	.7620	.8729	1060	640.5	559.1
10,000	483.0	268.3	20.58	17.55	2.015	.6877	.7385	.8593	1019	638.1	548.3
11,000	479.5	266.4	19.79	17.01	2.067	.6614	.7155	.8459	980.5	635.8	537.8
12,000	475.9	264.4	19.03	16.48	2.121	.6360	.6932	.8326	942.8	633.4	527.4
13,000	472.3	262.4	18.29	15.96	2.177	.6113	.6713	.8193	906.3	631.1	517.1
14,000	468.8	260.4	17.58	15.45	2.234	.5875	.6500	.8063	870.9	628.7	506.9
15,000	465.2	258.4	16.89	14.96	2.294	.5643	.6292	.7933	836.6	626.3	496.8
16,000	461.6	256.4	16.22	14.47	2.355	.5420	.6090	.7803	803.5	623.9	486.8
17,000	458.1	254.5	15.57	14.01	2.419	.5203	.5892	.7676	771.3	621.4	477.0
18,000	454.5	252.5	14.94	13.55	2.485	.4994	.5699	.7549	740.3	619.0	467.3
19,000	450.9	250.5	14.34	13.10	2.553	.4791	.5511	.7424	710.2	616.6	457.8
20,000	447.4	248.6	13.75	12.66	2.624	.4595	.5328	.7299	681.2	614.1	448.2
21,000	443.8	246.6	13.18	12.24	2.696	.4406	.5150	.7176	653.1	611.7	439.0
22,000	440.2	244.6	12.64	11.83	2.772	.4223	.4976	.7054	626.1	609.2	429.7
23,000	436.7	242.6	12.11	11.43	2.850	.4046	.4807	.6933	599.9	606.8	420.7
24,000	433.1	240.6	11.60	11.03	2.932	.3876	.4642	.6813	574.6	604.3	411.7
25,000	429.5	238.6	11.10	10.65	3.016	.3711	.4481	.6694	550.2	601.8	402.8
26,000	426.0	236.7	10.63	10.28	3.103	.3552	.4325	.6576	526.6	599.3	394.1
27,000	422.4	234.7	10.17	9.918	3.194	.3398	.4173	.6460	503.8	596.8	385.5
28,000	418.8	232.7	9.725	9.567	3.287	.3250	.4025	.6344	481.8	594.2	377.0
29,000	415.3	230.7	9.297	9.225	3.385	.3107	.3881	.6230	460.7	591.7	368.6

h feet	Temperature °F abs	Temperature °C abs	p in. Hg	$\rho \times 10^4$ slugs/ft^3	$\nu_{\frac{s}{\rho}} \times 10^4$ ft^2/sec	P/P$_o$	σ	$\sigma^{\frac{1}{2}}$	q/M^2	Knots a	Knots a$\sigma^{\frac{1}{2}}$
30,000	411.7	228.7	8.885	8.893	3.486	.2970	.3741	.6117	440.2	589.2	360.4
31,000	408.1	226.7	8.488	8.570	3.591	.2837	.3605	.6005	420.6	586.6	352.3
32,000	404.6	224.8	8.106	8.255	3.700	.2709	.3473	.5893	401.6	584.0	344.2
33,000	401.0	222.8	7.737	7.950	3.813	.2586	.3345	.5783	383.4	581.5	336.3
34,000	397.4	220.8	7.382	7.653	3.931	.2467	.3220	.5674	365.8	578.9	328.5
35,000	393.9	218.8	7.041	7.365	4.053	.2353	.3099	.5567	348.8	576.3	320.8
36,000	390.3	216.8	6.712	7.086	4.181	.2243	.2981	.5460	332.6	573.6	313.2
36,089	390.0	216.7	6.683	7.061	4.192	.2234	.2971	.5450	331.2	573.4	312.5
37,000	390.0	216.7	6.397	6.759	4.380	.2138	.2844	.5332	317.0	573.4	305.7
38,000	390.0	216.7	6.097	6.442	4.596	.2038	.2710	.5206	302.1	573.4	298.5
39,000	390.0	216.7	5.811	6.139	4.822	.1942	.2583	.5082	287.9	573.4	291.4
40,000	390.0	216.7	5.538	5.851	5.059	.1851	.2462	.4962	274.4	573.4	284.5
41,000	390.0	216.7	5.278	5.577	5.308	.1764	.2346	.4844	261.5	573.4	277.8
42,000	390.0	216.7	5.030	5.315	5.570	.1681	.2236	.4729	249.2	573.4	271.2
43,000	390.0	216.7	4.794	5.066	5.844	.1602	.2131	.4616	237.5	573.4	264.7
44,000	390.0	216.7	4.569	4.828	6.132	.1527	.2031	.4507	226.4	573.4	258.4
45,000	390.0	216.7	4.355	4.601	6.434	.1455	.1936	.4400	215.8	573.4	252.3
46,000	390.0	216.7	4.151	4.385	6.750	.1387	.1845	.4295	205.7	573.4	246.3
47,000	390.0	216.7	3.956	4.180	7.083	.1322	.1758	.4193	196.0	573.4	240.4
48,000	390.0	216.7	3.770	3.983	7.432	.1260	.1676	.4094	186.8	573.4	234.7
49,000	390.0	216.7	3.593	3.797	7.797	.1201	.1597	.3996	178.0	573.4	229.1
50,000	390.0	216.7	3.425	3.618	8.181	.1145	.1522	.3902	169.7	573.4	223.7
51,000	390.0	216.7	3.264	3.449	8.584	.1091	.1451	.3809	161.7	573.4	218.4
52,000	390.0	216.7	3.111	3.287	9.007	.1040	.1383	.3719	154.1	573.4	213.2
53,000	390.0	216.7	2.965	3.132	9.450	.0991	.1318	.3630	146.9	573.4	208.1
54,000	390.0	216.7	2.826	2.986	9.916	.0944	.1256	.3544	140.0	573.4	203.2
55,000	390.0	216.7	2.693	2.845	10.40	.0900	.1197	.3460	133.4	573.4	198.4
56,000	390.0	216.7	2.567	2.712	10.92	.0858	.1141	.3378	127.2	573.4	193.7
57,000	390.0	216.7	2.446	2.585	11.45	.0818	.1087	.3298	121.2	573.4	189.1
58,000	390.0	216.7	2.331	2.463	12.02	.0779	.1036	.3219	115.5	573.4	184.6
59,000	390.0	216.7	2.222	2.348	12.61	.0743	.0988	.3143	110.1	573.4	180.2
60,000	390.0	216.7	2.118	2.238	13.23	.0708	.0941	.3068	104.9	573.4	175.9
61,000	390.0	216.7	2.018	2.132	13.88	.0675	.0897	.2995	99.98	573.4	171.7
62,000	390.0	216.7	1.924	2.032	14.56	.0643	.0855	.2924	95.30	573.4	167.7
63,000	390.0	216.7	1.833	1.937	15.28	.0613	.0815	.2855	90.84	573.4	163.7
64,000	390.0	216.7	1.747	1.846	16.04	.0584	.0777	.2787	86.61	573.4	159.8
65,000	390.0	216.7	1.665	1.760	16.82	.0557	.0740	.2721	82.48	573.4	156.0

B. Properties of the Air Force-Navy Standard Hot Atmosphere

Altitude		Temperature		p	$\rho \times 10^4$	$\nu \times 10^4$	P/P$_o$	σ	$\sigma^{\frac{1}{2}}$	q/M^2	Knots	
h_p-ft	h_t-ft	°F$_{abs}$	°C$_{abs}$	in. Hg	slug/ft^3	ft^2/sec					a	$a\sigma^{\frac{1}{2}}$
0	0	562.7	312.6	29.92	21.91	1.822	1.0000	.9218	.9601	1483	688.8	661.3
1,000	1,084	558.7	310.4	28.86	21.28	1.866	.9644	.8954	.9462	1430	686.3	649.4
2,000	2,169	554.7	308.2	27.82	20.67	1.910	.9298	.8695	.9325	1379	683.9	637.7
3,000	3,253	550.7	305.9	26.82	20.07	1.957	.8962	.8442	.9188	1329	681.4	626.1
4,000	4,337	546.7	303.7	25.84	19.48	2.004	.8637	.8195	.9053	1280	678.9	614.6
5,000	5,421	542.7	301.5	24.90	18.90	2.053	.8320	.7953	.8919	1234	676.4	603.2
6,000	6,506	538.7	299.3	23.98	18.34	2.104	.8014	.7717	.8784	1188	673.9	592.0
7,000	7,590	534.7	297.0	23.09	17.79	2.156	.7716	.7486	.8652	1144	671.4	580.9
8,000	8,674	530.7	294.8	22.22	17.26	2.210	.7428	.7260	.8521	1101	668.9	569.9
9,000	9,758	526.7	292.6	21.39	16.73	2.265	.7148	.7040	.8390	1060	666.4	559.1
10,000	10,842	522.6	290.4	20.58	16.22	2.323	.6877	.6824	.8261	1019	663.8	548.4
11,000	11,925	518.7	288.1	19.79	15.72	2.382	.6614	.6614	.8133	980.5	661.3	537.8
12,000	13,007	514.7	285.9	19.03	15.23	2.443	.6360	.6409	.8006	942.8	658.7	527.4
13,000	14,090	510.7	283.7	18.29	14.76	2.506	.6113	.6209	.7880	906.3	656.2	517.0
14,000	15,172	506.7	281.5	17.58	14.29	2.572	.5875	.6014	.7755	870.9	653.6	506.8
15,000	16,254	502.7	279.3	16.89	13.84	2.639	.5643	.5823	.7631	836.6	651.0	496.8
16,000	17,337	498.7	277.0	16.22	13.40	2.709	.5420	.5637	.7508	803.5	648.4	486.8
17,000	18,419	494.7	274.8	15.57	12.97	2.781	.5203	.5456	.7386	771.3	645.8	477.0
18,000	19,502	490.7	272.6	14.94	12.55	2.855	.4994	.5279	.7265	740.3	643.2	467.3
19,000	20,584	486.7	270.4	14.34	12.14	2.933	.4791	.5106	.7146	710.2	640.6	457.7
20,000	21,666	482.7	268.2	13.75	11.74	3.012	.4595	.4937	.7027	681.2	637.9	448.3
21,000	22,746	478.7	265.9	13.18	11.35	3.095	.4406	.4774	.6909	653.1	635.3	438.8
22,000	23,826	474.7	263.7	12.64	10.97	3.180	.4223	.4614	.6793	626.1	632.6	429.7
23,000	24,906	470.7	261.5	12.11	10.60	3.269	.4046	.4459	.6677	599.9	630.0	420.7
24,000	25,986	466.7	259.3	11.60	10.24	3.360	.3876	.4307	.6563	574.6	627.3	411.7
25,000	27,065	462.7	257.1	11.10	9.887	3.455	.3711	.4160	.6450	550.2	624.6	402.8
26,000	28,145	458.8	254.9	10.63	9.546	3.553	.3552	.4016	.6337	526.6	621.9	394.1
27,000	29,225	454.8	252.6	10.17	9.213	3.655	.3398	.3876	.6226	503.8	619.2	385.5
28,000	30,305	450.8	250.4	9.725	8.889	3.761	.3250	.3740	.6115	481.8	616.5	377.0
29,000	31,385	446.8	248.2	9.297	8.574	3.871	.3107	.3607	.6006	460.7	613.8	368.6

B. Properties of the Air Force-Navy Standard Hot Atmosphere - cont'd.

Altitude h_p-ft	Altitude h_t-ft	Temperature $^oF_{abs}$	Temperature $^oC_{abs}$	p in. Hg	$\rho \times 10^4$ slug/ft^3	$\nu \times 10^4$ ft^2/sec	P/P_o	σ	$\sigma^{\frac{1}{2}}$	q/M^2	Knots a	Knots $a\sigma^{\frac{1}{2}}$
30,000	32,464	442.8	246.0	8.885	8.268	3.985	.2970	.3478	.5898	440.2	611.0	360.4
31,000	33,542	438.8	243.8	8.488	7.970	4.103	.2837	.3353	.5791	420.6	608.3	352.2
32,000	34,620	434.8	241.6	8.106	7.681	4.225	.2709	.3231	.5685	401.6	605.5	344.2
33,000	35,698	430.9	239.2	7.737	7.399	4.352	.2586	.3113	.5579	383.4	602.7	336.3
34,000	36,776	426.9	237.2	7.382	7.126	4.485	.2467	.2998	.5475	365.8	599.9	328.5
35,000	37,854	422.9	235.9	7.041	6.860	4.622	.2353	.2886	.5372	348.8	597.1	320.8
36,000	38,932	418.9	232.7	6.712	6.602	4.765	.2243	.2777	.5270	332.6	594.3	313.2
37,000	40,003	415.0	230.5	6.397	6.353	4.912	.2138	.2673	.5170	317.0	591.5	305.8
38,000	41,074	415.1	230.6	6.097	6.051	5.159	.2038	.2546	.5046	302.1	591.6	298.5
39,000	42,143	415.6	230.9	5.811	5.761	5.424	.1942	.2424	.4923	287.9	592.0	291.4
40,000	43,212	416.1	231.2	5.538	5.484	5.703	.1851	.2307	.4803	274.4	592.3	284.5
41,000	44,287	416.6	231.4	5.278	5.220	5.997	.1764	.2196	.4686	261.5	592.6	277.7
42,000	45,361	417.1	231.7	5.030	4.969	6.306	.1681	.2091	.4572	249.2	593.0	271.3
43,000	46,435	417.5	232.0	4.794	4.731	6.631	.1602	.1990	.4461	237.5	593.3	264.7
44,000	47,509	418.0	232.2	4.569	4.504	6.971	.1527	.1895	.4353	226.4	593.7	258.4
45,000	48,584	418.5	232.5	4.355	4.288	7.329	.1456	.1804	.4248	215.8	594.0	252.3
46,000	49,665	419.0	232.8	4.151	4.082	7.707	.1387	.1717	.4144	205.7	594.3	246.3
47,000	50,747	419.5	233.0	3.956	3.886	8.105	.1322	.1635	.4043	196.0	594.7	240.4
48,000	51,829	420.0	233.3	3.770	3.699	8.522	.1260	.1556	.3945	186.8	595.0	234.7
49,000	52,911	420.4	233.6	3.593	3.521	8.960	.1201	.1482	.3849	178.0	595.4	229.2
50,000	53,992	420.9	233.8	3.425	3.353	9.420	.1145	.1411	.3756	169.7	595.7	223.7
51,000	55,080	421.4	234.1	3.264	3.191	9.906	.1091	.1343	.3664	161.7	596.1	218.4
52,000	56,169	422.0	234.4	2.111	3.038	10.42	.1040	.1278	.3575	154.1	596.4	213.2
53,000	57,257	422.4	234.7	2.965	2.892	10.95	.0991	.1217	.3488	146.9	596.8	208.2
54,000	58,345	422.9	234.9	2.826	2.753	11.52	.0944	.1158	.3403	140.0	597.1	203.2
55,000	59,433	423.4	235.2	2.693	2.621	12.11	.0900	.1103	.3321	133.4	597.4	198.4
56,000	60,529	423.8	235.5	2.567	2.495	12.73	.0858	.1050	.3240	127.2	597.8	193.7
57,000	61,624	424.3	235.7	2.446	2.375	13.39	.0818	.0999	.3161	121.2	598.1	189.1
58,000	62,720	424.8	236.0	2.331	2.261	14.08	.0779	.0951	.3084	115.5	598.5	184.6
59,000	63,815	425.3	236.3	2.222	2.153	14.80	.0743	.0906	.3009	110.1	598.8	180.2
60,000	64,910	425.8	236.6	2.118	2.049	15.56	.0708	.0862	.2936	104.9	599.2	175.9

C. Speed of Sound in Air

t (°F)	0	1	2	3	4	5	6	7	8	9
	Speed of Sound, a - Knots									
-70	573.2									
-60	580.5	579.8	579.0	578.3	577.6	576.9	576.1	575.4	574.7	573.9
-50	587.7	587.0	586.3	585.6	584.8	584.1	583.4	582.7	581.9	581.2
-40	594.9	594.1	593.4	592.7	592.0	591.3	590.6	589.9	589.2	588.4
-30	601.9	601.2	600.5	599.8	599.1	598.4	597.7	597.0	596.3	595.6
-20	608.9	608.2	607.5	606.8	606.1	605.4	604.7	604.0	603.3	602.6
-10	615.7	615.1	614.4	613.7	613.0	612.3	611.6	610.9	610.2	609.6
- 0	622.5	621.9	621.2	620.5	619.8	619.2	618.5	617.8	617.1	616.4
0	622.5	623.2	623.9	624.6	625.3	625.9	626.6	627.3	627.9	628.6
10	629.2	629.9	630.6	631.3	632.0	632.6	633.3	634.0	634.6	635.3
20	635.9	636.6	637.3	637.9	638.6	639.3	639.9	640.6	641.2	641.9
30	642.5	643.2	643.9	644.5	645.2	645.8	646.5	647.1	647.8	648.4
40	649.1	649.7	650.4	651.0	651.7	652.3	653.0	653.6	654.3	654.9
50	655.5	656.2	656.8	657.5	658.1	658.7	659.4	660.0	660.7	661.3
60	661.9	662.6	663.2	663.8	664.5	665.1	665.7	666.4	667.0	667.6
70	668.3	668.9	669.5	670.2	670.8	671.4	672.0	672.7	673.3	673.9
80	674.5	675.2	675.8	676.4	677.0	677.7	678.3	678.9	679.5	680.1
90	680.8	681.4	682.0	682.6	683.2	683.9	684.5	685.1	685.7	686.3
100	686.9	687.5	688.2	688.8	689.4	690.0	690.6	691.2	691.8	692.4
110	693.0	693.6	694.3	694.9	695.5	696.1	696.7	697.3	697.9	698.5
120	699.1									

D. Dynamic Pressure q in Pounds Per Square Foot EAS In Knots

Equivalent Airspeed, EAS Knots	0	1	2	3	4	5	6	7	8	9
0	0	.0034	.0136	.0305	.0542	.0848	.1220	.1661	.2170	.2746
10	.3390	.4102	.4882	.5729	.6645	.7628	.8679	.9797	1.098	1.224
20	1.356	1.495	1.641	1.793	1.953	2.119	2.292	2.471	2.658	2.851
30	3.051	3.258	3.471	3.692	3.919	4.153	4.394	4.641	4.895	5.156
40	5.424	5.699	5.980	6.268	6.563	6.865	7.173	7.489	7.811	8.140
50	8.475	8.818	9.167	9.523	9.885	10.25	10.63	11.01	11.40	11.80
60	12.20	12.61	13.03	13.46	13.89	14.32	14.77	15.22	15.68	16.14
70	16.61	17.09	17.57	18.07	18.56	19.07	19.58	20.10	20.63	21.16
80	21.70	22.24	22.79	23.35	23.92	24.49	25.07	25.66	26.25	26.85
90	27.46	28.07	28.69	29.32	29.95	30.60	31.24	31.90	32.56	33.23
100	33.90	34.58	35.27	35.97	36.67	37.38	38.09	38.81	39.54	40.28
110	41.02	41.77	42.53	43.29	44.06	44.83	45.62	46.41	47.20	48.01
120	48.82	49.63	50.46	51.29	52.13	52.97	53.82	54.68	55.54	56.41
130	57.29	58.18	59.07	59.97	60.87	61.78	62.70	63.63	64.56	65.50
140	66.45	67.40	68.36	69.32	70.30	71.28	72.26	73.26	74.26	75.26
150	76.28	77.30	78.32	79.36	80.40	81.45	82.50	83.56	84.63	85.70
160	86.79	87.87	88.97	90.07	91.18	92.29	93.42	94.55	95.68	96.82
170	97.97	99.13	100.3	101.5	102.6	103.8	105.0	106.2	107.4	108.6
180	109.8	111.1	112.3	113.5	114.8	116.0	117.3	118.5	119.8	121.1
190	122.4	123.7	125.0	126.3	127.6	128.9	130.2	131.6	132.9	134.3
200	135.6	137.0	138.3	139.7	141.1	142.5	143.9	145.3	146.7	148.1
210	149.5	150.9	152.4	153.8	155.3	156.7	158.2	159.6	161.1	162.6
220	164.1	165.6	167.1	168.6	170.1	171.6	173.2	174.7	176.2	177.8
230	179.3	180.9	182.5	184.0	185.6	187.2	188.8	190.4	192.0	193.6
240	195.3	196.9	198.5	200.2	201.8	203.5	205.2	206.8	208.5	210.2

D. Dynamic Pressure q in Pounds Per Square Foot - cont'd. EAS In Knots

Equivalent Airspeed, EAS Knots	0	1	2	3	4	5	6	7	8	9
250	211.9	213.6	215.3	217.0	218.7	220.4	222.2	223.9	225.7	227.4
260	229.2	230.9	232.7	234.5	236.3	238.1	239.9	241.7	243.5	245.3
270	247.1	249.0	250.8	252.7	254.5	256.4	258.2	260.1	262.0	263.9
280	265.8	267.7	269.6	271.5	273.4	275.4	277.3	279.2	281.2	283.1
290	285.1	287.1	289.1	291.0	293.0	295.0	297.0	299.0	301.1	303.1
300	305.1	307.1	309.2	311.2	313.3	315.4	317.4	319.5	321.6	323.7
310	325.8	327.9	330.0	332.1	334.2	336.4	338.5	340.7	342.8	345.0
320	347.1	349.3	351.5	353.7	355.9	358.1	360.3	362.5	364.7	366.9
330	369.2	371.4	373.7	375.9	378.2	380.5	382.7	385.0	387.3	389.6
340	391.9	394.2	396.5	398.8	401.2	403.5	405.8	408.2	410.6	412.9
350	415.3	417.7	420.0	422.4	424.8	427.2	429.6	432.1	434.5	436.9
360	439.4	441.8	444.2	446.7	449.2	451.6	454.1	456.6	459.1	461.6
370	464.1	466.6	469.1	471.7	474.2	476.7	479.3	481.8	484.4	487.0
380	489.5	492.1	494.7	497.3	499.9	502.5	505.1	507.7	510.4	513.0
390	515.6	518.3	520.9	523.6	526.3	528.9	531.6	534.3	537.0	539.7
400	542.4	545.1	547.9	550.6	553.3	556.1	558.8	561.6	564.3	567.1
410	569.9	572.7	575.4	578.2	581.0	583.9	586.7	589.5	592.3	595.2
420	598.0	600.9	603.7	606.6	609.5	612.3	615.2	618.1	621.0	623.9
430	626.8	629.7	632.7	635.6	638.5	641.5	644.4	647.4	650.4	653.3
440	656.3	659.3	662.3	665.3	668.3	671.3	674.3	677.4	680.4	683.4
450	686.5	689.5	692.6	695.7	698.7	701.8	704.9	708.0	711.1	714.2
460	717.3	720.5	723.6	726.7	729.9	733.0	736.2	739.3	742.5	745.7
470	748.9	752.1	755.3	758.5	761.7	764.9	768.1	771.3	774.6	777.8
480	781.1	784.3	787.6	790.9	794.1	797.4	800.7	804.0	807.3	810.6
490	814.0	817.3	820.6	824.0	827.3	830.7	834.0	837.4	840.8	844.1

D. Dynamic Pressure q in Pounds Per Square Foot - cont'd. EAS In Knots

Equivalent Airspeed, EAS Knots	0	1	2	3	4	5	6	7	8	9
500	847.5	850.9	854.3	857.7	861.1	864.6	868.0	871.4	874.9	878.3
510	881.8	885.2	888.7	892.2	895.6	899.1	902.6	906.1	909.6	913.1
520	916.7	920.2	923.7	927.3	930.8	934.4	938.0	941.5	945.1	948.7
530	952.3	955.9	959.5	963.1	966.7	970.3	974.0	977.6	981.2	984.9
540	988.5	992.2	995.9	999.6	1003.2	1006.9	1010.6	1014.3	1018.1	1021.8
550	1025.5	1029.2	1033.0	1036.7	1040.5	1044.2	1048.0	1051.8	1055.5	1059.3
560	1063.1	1066.9	1070.7	1074.5	1078.4	1082.2	1086.0	1089.9	1093.7	1097.6
570	1101.4	1105.3	1109.2	1113.1	1116.9	1120.8	1124.7	1128.7	1132.6	1136.5
580	1140.4	1144.4	1148.3	1152.2	1156.2	1160.2	1164.1	1168.1	1172.1	1176.1
590	1180.1	1184.1	1188.1	1192.1	1196.2	1200.2	1204.2	1208.3	1212.3	1216.4
600	1220.4	1224.5	1228.6	1232.7	1236.8	1240.9	1245.0	1249.1	1253.2	1257.3
610	1261.4	1265.6	1269.7	1273.9	1278.0	1282.2	1286.4	1290.6	1294.8	1298.9
620	1303.1	1307.4	1311.6	1315.8	1320.0	1324.2	1328.5	1332.7	1337.0	1341.3
630	1345.5	1349.8	1354.1	1358.4	1362.7	1367.0	1371.3	1375.6	1379.9	1384.2
640	1388.6	1392.9	1397.3	1401.6	1406.0	1410.4	1414.7	1419.1	1423.5	1427.9
650	1432.3	1436.7	1441.1	1445.6	1450.0	1454.4	1458.9	1463.3	1467.8	1472.2
660	1476.7	1481.2	1485.7	1490.2	1494.7	1499.2	1503.7	1508.2	1512.7	1517.3
670	1521.8	1526.4	1530.9	1535.5	1540.0	1544.6	1549.2	1554.0	1558.4	1563.0
680	1567.6	1572.2	1576.8	1581.4	1586.1	1590.7	1595.4	1600.0	1604.7	1609.3
690	1614.0	1618.7	1623.4	1628.1	1632.8	1637.5	1642.2	1646.9	1651.7	1656.4
700	1661.1	1665.9	1670.6	1675.4	1680.2	1685.0	1689.7	1694.5	1699.3	1704.1
710	1708.9	1713.8	1718.6	1723.4	1728.2	1733.1	1737.9	1742.8	1747.7	1752.5
720	1757.4	1762.3	1767.2	1772.1	1777.0	1781.9	1786.8	1791.8	1796.7	1801.6
730	1806.6	1811.5	1816.5	1821.5	1826.4	1831.4	1836.4	1841.4	1846.4	1851.4
740	1856.4	1861.4	1866.5	1871.5	1876.5	1881.6	1886.6	1891.7	1896.8	1901.8

D. Dynamic Pressure q in Pounds Per Square Foot - cont'd. EAS In Knots

Equivalent Airspeed, EAS Knots	0	1	2	3	4	5	6	7	8	9
750	1906.9	1912.0	1917.1	1922.2	1927.3	1932.4	1937.6	1942.7	1947.8	1953.0
760	1958.1	1963.2	1968.4	1973.6	1978.8	1984.0	1989.1	1994.3	1999.5	2004.8
770	2010.0	2015.2	2020.4	2025.7	2030.9	2036.2	2041.4	2046.7	2052.0	2057.2
780	2062.5	2067.8	2073.1	2078.4	2083.7	2089.1	2094.4	2099.7	2105.0	2110.4
790	2115.7	2121.1	2126.5	2131.8	2137.2	2142.6	2148.0	2153.4	2158.8	2164.2
800	2169.7	2175.1	2180.5	2186.0	2191.4	2196.9	2202.3	2207.8	2213.3	2218.7
810	2224.2	2229.7	2235.2	2240.7	2246.3	2251.8	2257.3	2262.8	2268.4	2273.9
820	2279.5	2284.1	2290.6	2296.2	2301.8	2307.4	2313.0	2318.6	2324.2	2329.8
830	2335.4	2341.1	2346.7	2352.3	2358.0	2363.6	2369.3	2375.0	2380.7	2386.3
840	2392.0	2397.7	2403.4	2409.2	2414.9	2420.6	2426.3	2432.1	2437.8	2443.6
850	2449.3	2455.1	2460.9	2466.7	2472.4	2478.2	2484.0	2489.8	2495.7	2501.5
860	2507.3	2513.1	2519.0	2524.8	2530.7	2536.5	2542.4	2548.3	2554.2	2560.1
870	2565.9	2571.9	2577.8	2583.7	2589.6	2595.5	2601.5	2607.4	2613.4	1619.3
880	2625.3	2631.2	2637.2	2643.2	2649.2	2655.2	2661.2	2667.2	2673.2	2679.2
890	2685.3	2691.3	2697.4	2703.4	2709.5	2715.5	2721.6	2727.7	2733.8	2739.9
900	2746.0	2752.1	2758.2	2764.3	2770.4	2776.6	2782.7	2788.8	2795.0	2801.2
910	2807.3	2813.5	2819.7	2825.9	2832.1	2838.3	2844.5	2850.7	2856.9	2863.1
920	2869.4	2875.6	2881.9	2888.1	2894.4	2900.6	2906.9	2913.2	2919.5	2925.8
930	2932.1	2938.4	2944.7	2951.0	2957.4	2963.7	2970.0	2976.4	2982.7	2989.1
940	2995.5	3001.8	3008.2	3014.6	3021.0	3027.4	3033.8	3040.3	3046.7	3053.1
950	3059.5	3066.0	3072.4	3078.9	3085.4	3091.8	3098.3	3104.8	3111.3	3117.8
960	3124.3	3130.8	3137.3	3143.9	3150.4	3156.9	3163.5	3170.0	3176.6	3183.2
970	3189.7	3196.3	3202.9	3209.5	3216.1	3222.7	3229.3	3235.9	3242.6	3249.2
980	3255.8	3262.5	3269.1	3275.8	3282.5	3289.1	3295.8	3302.5	3309.2	3315.9
990	3322.6	3329.3	3336.1	3342.8	3349.5	3356.3	3363.0	3369.8	3376.5	3383.3

D. Dynamic Pressure q in Pounds Per Square Foot - cont'd. EAS In Knots

Equivalent Airspeed, EAS Knots	0	1	2	3	4	5	6	7	8	9
1000	3390.0	3396.9	3403.7	3410.4	3417.3	3424.1	3430.9	3437.7	3444.5	3451.4
1010	3458.2	3465.1	3471.9	3478.8	3485.7	3492.5	3499.4	3506.3	3513.2	3520.1
1020	3527.0	3534.0	3540.9	3547.8	3554.8	3561.7	3568.7	3575.6	3582.6	3589.6
1030	3596.5	3603.5	3610.5	3617.5	3624.5	3631.5	3638.6	3645.6	3652.6	3659.7
1040	3666.7	3673.8	3680.8	3687.9	3695.0	3702.0	3709.1	3716.2	3723.3	3730.4
1050	3737.6	3744.7	3751.8	3758.9	3766.1	3773.2	3780.4	3787.6	3794.7	3801.9
1060	3809.1	3816.3	3823.5	3830.7	3837.9	3845.1	3852.3	3859.6	3866.8	3874.0
1070	3881.3	3888.6	3895.8	3903.1	3910.4	3917.7	3924.9	3932.2	3939.6	3946.9
1080	3954.2	3961.5	3968.8	3976.2	3983.5	3990.9	3998.2	4005.6	4013.0	4020.4
1090	4027.8	4035.1	4042.5	4050.0	4057.4	4064.8	4072.2	4079.6	4087.1	4094.5
1100	4102.0	4109.5	4116.9	4124.4	4131.9	4139.4	4146.9	4154.4	4161.9	4169.4
1110	4176.9	4184.4	4192.0	4199.5	4207.1	4214.6	4222.2	4229.8	4237.3	4244.9
1120	4252.5	4260.1	4267.7	4275.3	4282.9	4290.6	4298.2	4305.8	4313.5	4321.1
1130	4328.8	4336.5	4344.1	4351.8	4359.5	4367.2	4374.9	4382.6	4390.5	4398.0
1140	4405.7	4413.5	4421.2	4429.0	4436.7	4444.5	4452.2	4460.0	4467.8	4475.6
1150	4483.4	4491.2	4499.0	4506.8	4514.6	4522.4	4530.3	4538.1	4546.0	4553.8
1160	4561.7	4569.6	4577.4	4585.3	4593.2	4601.1	4609.0	4616.9	4624.8	4632.7
1170	4640.7	4648.6	4656.6	4664.5	4672.5	4680.4	4688.4	4696.4	4704.4	4712.3
1180	4720.3	4728.3	4736.4	4744.4	4752.4	4760.4	4768.5	4776.5	4784.6	4792.6
1190	4800.7	4808.8	4816.8	4824.9	4833.0	4841.1	4849.2	4857.3	4865.5	4873.6
1200	4881.7	4889.9	4898.0	4906.1	4914.3	4922.5	4930.7	4938.8	4947.0	4955.2
1210	4963.4	4971.8	4979.8	4988.1	4996.3	5004.5	5012.8	5021.0	5029.3	5037.5
1220	5045.8	5054.1	5062.3	5070.6	5078.9	5087.2	5095.5	5103.9	5112.2	5120.5
1230	5128.8	5137.2	5145.5	5153.9	5162.3	5170.6	5179.0	5187.4	5195.8	5204.2
1240	5212.6	5221.0	5229.4	5242.0	5246.3	5254.7	5263.1	5271.6	5280.1	5288.5

D. Dynamic Pressure q in Pounds Per Square Foot - cont'd. EAS In Knots

Equivalent Airspeed, EAS Knots	0	1	2	3	4	5	6	7	8	9
1250	5297.0	5305.5	5314.0	5322.5	5331.0	5339.5	5348.0	5356.5	5365.0	5373.5
1260	5382.1	5390.6	5399.2	5407.7	5416.3	5424.9	5433.5	5442.1	5450.6	5459.2
1270	5467.9	5476.5	5485.1	5493.7	5502.4	5511.0	5519.6	5528.3	5537.0	5545.6
1280	5554.3	5563.0	5571.7	5580.4	5589.1	5597.8	5606.5	5615.2	5623.9	5632.7
1290	5641.4	5650.2	5658.9	5667.7	5676.5	5685.2	5694.0	5702.8	5711.6	5720.4
1300	5729.2	5738.0	5746.9	5755.7	5764.5	5773.4	5782.2	5791.1	5800.0	5808.8
1310	5817.7	5826.6	5835.5	5844.4	5853.3	5862.2	5871.1	5880.0	5889.0	5897.9
1320	5906.9	5915.8	5924.8	5933.8	5942.7	5951.7	5960.7	5969.7	5978.7	5987.7
1330	5996.7	6005.7	6014.8	6023.8	6032.8	6041.9	6050.9	6060.0	6069.1	6078.1
1340	6087.2	6096.3	6105.4	6114.5	6123.6	6132.7	6141.9	6151.0	6160.1	6169.3
1350	6178.4	6187.6	6196.7	6205.9	6215.1	6224.3	6233.5	6242.7	6251.9	6261.1
1360	6270.3	6279.5	6288.7	6298.0	6307.2	6316.5	6325.7	6335.0	6344.3	6353.6
1370	6362.8	6372.1	6381.4	6390.7	6400.0	6409.4	6418.7	6428.0	6437.4	6446.7
1380	6456.1	6465.4	6474.8	6484.2	6493.5	6502.9	6512.3	6521.7	6531.1	6540.5
1390	6550.0	6559.4	6568.8	6578.3	6587.7	6597.2	6606.6	6616.1	6625.6	6635.1
1400	6644.6	6654.0	6663.5	6673.1	6682.6	6692.1	6701.6	6711.2	6720.7	6730.3
1410	6739.8	6749.4	6758.9	6768.5	6778.1	6787.7	6797.3	6806.9	6816.5	6826.1
1420	6835.8	6845.4	6855.0	6864.7	6874.3	6884.0	6893.6	6903.3	6913.0	6922.7
1430	6933.4	6942.1	6951.8	6961.5	6971.2	6980.9	6990.7	7000.4	7010.2	7019.9
1440	7029.7	7039.4	7049.2	7059.0	7068.8	7078.6	7088.4	7098.2	7108.0	7117.8
1450	7127.6	7137.5	7147.3	7157.2	7167.0	7176.9	7186.7	7196.6	7206.5	7216.4
1460	7226.3	7236.2	7246.1	7256.0	7265.9	7275.9	7285.8	7295.7	7305.7	7315.7
1470	7325.6	7334.4	7345.6	7355.5	7365.5	7375.5	7385.5	7395.6	7405.6	7417.3
1480	7425.6	7435.7	7445.7	7455.8	7465.8	7475.9	7486.0	7496.1	7506.1	7516.2
1490	7526.3	7536.4	7546.5	7556.6	7566.8	7576.9	7587.0	7597.2	7607.3	7617.5

Impact Pressure q_c in Pounds Per Square Foot — CAS In Knots

Calibrated Airspeed, CAS (knots)	0	1	2	3	4	5	6	7	8	9
0	0	0.0034	0.0136	0.0305	0.0542	0.0848	0.1221	0.1661	0.2170	0.2746
10	.3390	0.4102	0.4882	0.5730	0.6645	0.7629	0.8680	0.9799	1.099	1.224
20	1.356	1.495	1.641	1.794	1.953	2.120	2.293	2.472	2.659	2.852
30	3.053	3.260	3.473	3.694	3.922	4.156	4.397	4.645	4.899	5.161
40	5.429	5.704	5.986	6.275	6.570	6.873	7.182	7.498	7.821	8.151
50	8.487	8.831	9.181	9.538	9.902	10.27	10.65	11.03	11.43	11.82
60	12.23	12.64	13.06	13.49	13.92	14.36	14.80	15.26	15.72	16.18
70	16.66	17.14	17.63	18.12	18.62	19.13	19.65	20.17	20.70	21.23
80	21.78	22.33	22.88	23.45	24.02	24.59	25.18	25.77	26.37	26.97
90	27.59	28.21	28.83	29.47	30.11	30.75	31.41	32.07	32.74	33.41
100	34.09	34.78	35.48	36.18	36.89	37.61	38.34	39.07	39.81	40.55
110	41.30	42.06	42.83	43.60	44.39	45.17	45.97	46.77	47.58	48.40
120	49.22	50.05	50.89	51.73	52.59	53.44	54.31	55.18	56.07	56.95
130	57.85	58.75	59.66	60.58	61.50	62.43	63.37	64.31	65.27	66.23
140	67.19	68.17	69.15	70.14	71.13	72.14	73.15	74.17	75.19	76.22
150	77.26	78.31	79.36	80.43	81.49	82.57	83.66	84.75	85.84	86.95
160	88.06	89.18	90.31	91.45	92.59	93.74	94.90	96.06	97.24	98.42
170	99.60	100.8	102.0	103.2	104.4	105.7	106.9	108.1	109.4	110.6
180	111.9	113.2	114.4	115.7	117.0	118.3	119.6	120.9	122.3	123.6
190	124.9	126.3	127.6	129.0	130.4	131.7	133.1	134.5	135.9	137.3
200	138.7	140.2	141.6	143.0	144.5	145.9	147.4	148.9	150.3	151.8
210	153.3	154.8	156.3	157.8	159.4	160.9	162.4	164.0	165.5	167.1
220	168.7	170.2	171.8	173.4	175.0	176.6	178.3	179.9	181.5	183.2
230	184.8	186.5	188.2	189.8	191.5	193.2	194.9	196.6	198.3	200.1
240	201.8	203.5	205.3	207.0	208.8	210.6	212.3	214.1	215.9	217.7

Impact Pressure q_c In Pounds Per Square Foot - cont'd CAS In Knots

Calibrated Airspeed, CAS (knots)	0	1	2	3	4	5	6	7	8	9
250	219.6	221.4	223.2	225.1	226.9	228.8	230.6	232.5	234.4	236.3
260	238.2	240.1	242.0	243.9	245.8	247.8	249.7	251.7	253.7	255.6
270	257.6	259.6	261.6	263.6	265.6	267.7	269.7	271.7	273.8	275.8
280	277.9	280.0	282.1	284.2	286.3	288.4	290.5	292.6	294.8	296.9
290	299.1	301.2	303.4	305.6	307.8	310.0	312.2	314.4	316.6	318.9
300	321.1	323.4	325.6	327.9	330.2	332.5	334.8	337.1	339.4	341.7
310	344.1	346.4	348.8	351.1	353.5	355.9	358.3	360.7	363.1	365.5
320	367.9	370.4	372.8	375.3	377.7	380.2	382.7	385.2	387.7	390.2
330	392.7	395.3	397.8	400.4	402.9	405.5	508.1	410.7	413.3	415.9
340	418.5	421.1	423.7	426.4	429.0	431.7	434.4	437.1	439.8	442.5
350	445.2	447.9	450.6	453.4	456.1	458.9	461.7	464.5	467.3	470.1
360	472.9	475.7	478.5	481.4	484.2	487.1	490.0	492.9	495.7	498.7
370	501.6	504.5	507.4	510.4	513.3	516.3	519.3	522.3	525.3	528.3
380	531.3	534.3	537.3	540.4	543.5	546.5	549.6	552.7	555.8	558.9
390	562.0	565.2	568.3	571.5	574.6	577.8	581.0	584.2	587.4	590.6
400	593.9	597.1	600.3	603.6	606.9	610.2	613.5	616.8	620.1	623.4
410	626.8	630.1	633.5	636.8	640.2	643.6	647.0	650.4	653.9	657.3
420	660.8	664.2	667.7	671.2	674.7	678.2	681.7	685.2	688.8	692.3
430	695.9	699.5	703.1	706.7	710.3	713.9	717.5	721.2	724.8	728.5
440	732.2	735.9	739.6	743.3	747.0	750.8	754.5	758.3	762.1	765.9
450	769.7	773.5	777.3	781.2	785.0	788.9	792.7	796.6	800.5	804.4
460	803.4	812.3	816.2	820.2	824.2	828.2	832.2	836.2	840.2	844.2
470	848.3	852.3	856.4	860.5	864.6	868.7	872.8	876.9	881.1	885.3
480	889.4	893.6	897.8	902.0	906.3	910.5	914.7	919.0	923.3	927.6
490	931.9	936.2	940.5	944.9	949.2	953.6	958.0	962.4	966.8	971.2

Impact Pressure q_c in Pounds Per Square Foot - cont'd CAS In Knots

Calibrated Airspeed, CAS (knots)	0	1	2	3	4	5	6	7	8	9
500	975.7	980.1	984.6	989.0	993.5	998.0	1003	1007	1012	1016
510	1021	1025	1030	1035	1039	1044	1048	1053	1058	1063
520	1067	1072	1077	1081	1086	1091	1096	1101	1105	1110
530	1115	1120	1125	1130	1135	1140	1145	1150	1154	1159
540	1164	1169	1175	1180	1185	1190	1195	1200	1205	1210
550	1215	1220	1226	1231	1236	1241	1246	1252	1257	1262
560	1268	1273	1278	1284	1289	1294	1300	1305	1311	1316
570	1321	1327	1332	1338	1343	1349	1355	1360	1366	1371
580	1377	1382	1388	1394	1400	1405	1411	1417	1422	1428
590	1434	1440	1446	1451	1457	1463	1469	1475	1481	1487
600	1493	1499	1505	1511	1517	1523	1529	1535	1541	1547
610	1553	1559	1565	1571	1578	1584	1590	1596	1603	1609
620	1615	1621	1628	1634	1641	1647	1653	1660	1666	1673
630	1679	1686	1692	1699	1705	1712	1718	1725	1732	1738
640	1745	1751	1758	1765	1772	1778	1785	1792	1799	1806
650	1812	1819	1826	1833	1840	1847	1854	1861	1868	1875
660	1882	1889	1896	1903	1910	1917	1925	1932	1939	1946
670	1953	1961	1968	1975	1982	1990	1997	2005	2012	2019
680	2027	2034	2042	2049	2057	2064	2072	2079	2087	2095
690	2102	2110	2118	2125	2133	2141	2149	2156	2164	2172
700	2180	2188	2196	2204	2212	2220	2228	2236	2244	2252
710	2260	2268	2276	2284	2292	2300	2309	2317	2325	2333
720	2342	2350	2358	2367	2375	2383	2392	2400	2409	2417
730	2426	2434	2443	2452	2460	2469	2477	2486	2495	2504
740	2512	2521	2530	2539	2548	2557	2565	2574	2583	2592

Impact Pressure q_c in Pounds Per Square Foot - cont'd CAS In Knots

Calibrated Airspeed, CAS (knots)	0	1	2	3	4	5	6	7	8	9
750	2601	2610	2619	2628	2638	2647	2656	2665	2674	2683
760	2693	2702	2711	2721	2730	2739	2749	2758	2767	2777
770	2786	2796	2806	2815	2825	2834	2844	2854	2863	2873
780	2883	2893	2902	2912	2922	2932	2942	2952	2962	2972
790	2982	2992	3002	3012	3022	3032	3043	3053	3063	3073
800	3084	3094	3104	3115	3125	3135	3146	3156	3167	3177
810	3188	3199	3209	3220	3230	3241	3252	3263	3273	3284
820	3295	3306	3317	3328	3339	3350	3361	3372	3383	3394
830	3405	3416	3428	3439	3450	3461	3473	3484	3495	3507
840	3518	3530	3541	3553	3564	3576	3588	3599	3611	3623
850	3634	3646	3658	3670	3682	3694	3706	3718	3730	3742
860	3754	3766	3778	3790	3802	3814	3827	3839	3851	3864
870	3876	3888	3901	3913	3926	3938	3951	3964	3976	3989
880	4002	4014	4027	4040	4053	4066	4079	4092	4105	4118
890	4131	4144	4157	4170	4183	4196	4210	4223	4236	4250
900	4263	4276	4290	4303	4317	4330	4344	4358	4371	4385
910	4399	4413	4426	4440	4454	4468	4482	4496	4510	4524
920	4538	4552	4567	4581	4595	4609	4624	4638	4653	4667
930	4681	4696	4711	4725	4740	4754	4769	4784	4799	4814
940	4828	4843	4858	4873	4888	4903	4918	4934	4949	4964
950	4979	4994	5010	5025	5041	5056	5072	5087	5103	5118
960	5134	5150	5165	5181	5197	5213	5229	5245	5261	5277
970	5293	5309	5325	5341	5357	5374	5390	5406	5423	5439
980	5456	5472	5489	5505	5522	5539	5555	5572	5589	5606
990	5623	5640	5657	5674	5691	5708	5725	5742	5760	5777

Impact Pressure q_c in Pounds Per Square Foot - Cont'd CAS In Knots

Calibrated Airspeed, CAS (knots)	0	1	2	3	4	5	6	7	8	9
1000	5794	5812	5829	5847	5864	5882	5899	5917	5935	5953
1010	5970	5988	6006	6024	6042	6060	6078	6096	6115	6133
1020	6151	6169	6187	6206	6225	6243	6262	6280	6299	6318
1030	6336	6355	6374	6393	6412	6431	6450	6469	6488	6507
1040	6526	6546	6565	6584	6604	6623	6643	6662	6682	6702
1050	6721	6741	6761	6781	6801	6821	6841	6861	6881	6901
1060	6921	6942	6962	6982	7003	7023	7044	7064	7085	7106
1070	7126	7147	7168	7189	7210	7231	7252	7273	7294	7316
1080	7337	7358	7380	7401	7423	7444	7466	7487	7509	7531
1090	7553	7575	7597	7619	7641	7663	7685	7707	7729	7752
1100	7774	7796	7819	7842	7864	7887	7910	7932	7955	7978
1110	8001	8024	8047	8070	8094	8117	8140	8163	8187	8210
1120	8234	8258	8281	8305	8329	8353	8376	8400	8424	8449
1130	8473	8497	8521	8545	8570	8594	8619	8643	8668	8693
1140	8718	8742	8767	8792	8817	8842	8867	8893	8918	8943
1150	8969	8994	9020	9045	9071	9096	9122	9148	9174	9200
1160	9226	9252	9278	9305	9331	9357	9384	9410	9437	9463
1170	9490	9517	9544	9570	9597	9624	9652	9679	9706	9733
1180	9761	9788	9816	9843	9871	9898	9926	9954	9982	10010
1190	10038	10066	10094	10123	10151	10179	10208	10236	10265	10294
1200	10323	10351	10380	10409	10438	10467	10497	10526	10555	10585
1210	10614	10644	10673	10703	10733	10763	10793	10823	10853	10883
1220	10913	10943	10974	11004	11035	11065	11096	11127	11158	11189
1230	11220	11251	11282	11313	11344	11376	11407	11439	11470	11502
1240	11534	11566	11598	11630	11662	11694	11726	11758	11791	11823

Impact Pressure q_c in Pounds Per Square Foot - cont'd CAS In Knots

Calibrated Airspeed, CAS (knots)	0	1	2	3	4	5	6	7	8	9
1250	11856	11888	11921	11954	11987	12020	12053	12086	12119	12152
1260	12186	12219	12253	12286	12320	12354	12388	12422	12456	12490
1270	12524	12558	12593	12627	12662	12696	12731	12766	12801	12836
1280	12871	12906	12941	12976	13012	13047	13083	13118	13154	13190
1290	13226	13262	13298	13334	13371	13407	13443	13480	13516	13553
1300	13590	13627	13664	13701	13738	13775	13813	13850	13888	13925
1310	13963	14001	14039	14077	14115	14153	14191	14230	14268	14307
1320	14345	14384	14423	14462	14501	14540	14579	14619	14658	14698

F. Mach Number versus Pressure Ratio

q_c/p	0	1	2	3	4	5	6	7	8	9
0.00	0.0000	0.0378	0.0534	0.0654	0.0755	0.0844	0.0924	0.0998	0.1067	0.1132
.01	.1193	.1251	.1306	.1359	.1410	.1459	.1507	.1553	.1598	.1641
.02	.1684	.1725	.1765	.1805	.1843	.1881	.1918	.1954	.1989	.2024
.03	.2058	.2092	.2125	.2158	.2190	.2221	.2253	.2283	.2314	.2343
.04	.2373	.2402	.2431	.2459	.2487	.2515	.2542	.2569	.2596	.2622
.05	.2648	.2674	.2700	.2725	.2750	.2775	.2800	.2824	.2848	.2872
.06	.2896	.2920	.2943	.2966	.2989	.3012	.3034	.3057	.3079	.3101
.07	.3123	.3145	.3166	.3187	.3209	.3230	.3251	.3271	.3292	.3312
.08	.3333	.3353	.3373	.3393	.3413	.3433	.3452	.3472	.3491	.3510
.09	.3529	.3548	.3567	.3586	.3604	.3623	.3641	.3659	.3678	.3696
.10	.3714	.3732	.3750	.3767	.3785	.3802	.3820	.3837	.3854	.3872
.11	.3889	.3906	.3923	.3939	.3956	.3973	.3989	.4006	.4022	.4039
.12	.4055	.4071	.4087	.4103	.4119	.4135	.4151	.4167	.4182	.4198
.13	.4214	.4229	.4245	.4260	.4275	.4290	.4306	.4321	.4336	.4351
.14	.4366	.4381	.4395	.4410	.4425	.4439	.4454	.4468	.4483	.4497
.15	.4512	.4526	.4540	.4554	.4568	.4583	.4597	.4611	.4624	.4638
.16	.4652	.4666	.4680	.4693	.4707	.4721	.4734	.4748	.4761	.4774
.17	.4788	.4801	.4814	.4828	.4841	.4854	.4867	.4880	.4893	.4906
.18	.4919	.4932	.4945	.4957	.4970	.4983	.4995	.5008	.5021	.5033
.19	.5046	.5058	.5071	.5083	.5095	.5108	.5120	.5132	.5144	.5157
.20	.5169	.5181	.5193	.5205	.5217	.5229	.5241	.5253	.5265	.5277
.21	.5288	.5300	.5312	.5323	.5335	.5347	.5358	.5370	.5382	.5393
.22	.5404	.5416	**.5427**	.5439	.5450	.5461	.5473	.5484	.5495	.5506
.23	.5518	.5529	.5540	.5551	.5562	.5573	.5584	.5595	.5606	.5617
.24	.5628	.5639	.5649	.5660	.5671	.5682	.5692	.5703	.5714	.5725

F. Mach Number versus Pressure Ratio - cont'd.

q_o/p	0	1	2	3	4	5	6	7	8	9
.25	.5735	.5746	.5756	.5767	.5777	.5788	.5798	.5809	.5819	.5830
.26	.5840	.5850	.5861	.5871	.5881	.5892	.5902	.5912	.5922	.5932
.27	.5942	.5953	.5963	.5973	.5983	.5993	.6003	.6013	.6023	.6033
.28	.6043	.6052	.6062	.6072	.6082	.6092	.6102	.6111	.6121	.6131
.29	.6141	.6150	.6160	.6170	.6179	.6189	.6198	.6208	.6217	.6227
.30	.6236	.6246	.6255	.6265	.6274	.6284	.6293	.6302	.6312	.6321
.31	.6330	.6340	.6349	.6358	.6367	.6377	.6386	.6395	.6404	.6413
.32	.6422	.6432	.6441	.6450	.6459	.6468	.6477	.6486	.6495	.6504
.33	.6513	.6522	.6531	.6539	.6548	.6557	.6566	.6575	.6584	.6593
.34	.6601	.6610	.6619	.6628	.6636	.6645	.6654	.6662	.6671	.6680
.35	.6688	.6697	.6705	.6714	.6723	.6731	.6740	.6748	.6757	.6765
.36	.6774	.6782	.6790	.6799	.6807	.6816	.6824	.6832	.6841	.6849
.37	.6857	.6866	.6874	.6882	.6891	.6899	.6907	.6915	.6924	.6932
.38	.6940	.6948	.6956	.6964	.6972	.6981	.6989	.6997	.7005	.7013
.39	.7021	.7029	.7037	.7045	.7053	.7061	.7069	.7077	.7085	.7093
.40	.7101	.7109	.7116	.7124	.7132	.7140	.7148	.7156	.7163	.7171
.41	.7179	.7187	.7195	.7202	.7210	.7218	.7226	.7233	.7241	.7249
.42	.7256	.7264	.7272	.7279	.7287	.7294	.7302	.7310	.7317	.7325
.43	.7332	.7340	.7347	.7355	.7362	.7370	.7377	.7385	.7392	.7400
.44	.7407	.7414	.7422	.7429	.7437	.7444	.7451	.7459	.7466	.7473
.45	.7481	.7488	.7495	.7503	.7510	.7517	.7525	.7532	.7539	.7546
.46	.7553	.7561	.7568	.7575	.7582	.7589	.7597	.7604	.7611	.7618
.47	.7625	.7632	.7639	.7646	.7653	.7660	.7668	.7675	.7682	.7689
.48	.7696	.7703	.7710	.7717	.7724	.7731	.7738	.7745	.7751	.7758
.49	.7765	.7772	.7779	.7786	.7793	.7800	.7807	.7813	.7820	.7827

F. Mach Number versus Pressure Ratio - cont'd.

q_c/P	0	1	2	3	4	5	6	7	8	9
.50	.7834	.7841	.7848	.7854	.7861	.7868	.7875	.7881	.7888	.7895
.51	.7902	.7908	.7915	.7922	.7929	.7935	.7942	.7949	.7955	.7962
.52	.7969	.7975	.7982	.7988	.7995	.8002	.8008	.8015	.8021	.8028
.53	.8035	.8041	.8048	.8054	.8061	.8067	.8074	.8080	.8087	.8093
.54	.8100	.8106	.8113	.8119	.8126	.8132	.8138	.8145	.8151	.8158
.55	.8164	.8170	.8177	.8183	.8190	.8196	.8202	.8209	.8215	.8221
.56	.8228	.8234	.8240	.8247	.8253	.8259	.8265	.8272	.8278	.8284
.57	.8290	.8297	.8303	.8309	.8315	.8322	.8328	.8334	.8340	.8346
.58	.8352	.8359	.8365	.8371	.8377	.8383	.8389	.8395	.8402	.8408
.59	.8414	.8420	.8426	.8432	.8438	.8444	.8450	.8456	.8462	.8468
.60	.8474	.8480	.8486	.8492	.8498	.8504	.8510	.8516	.8522	.8528
.61	.8534	.8540	.8546	.8552	.8558	.8564	.8570	.8576	.8582	.8587
.62	.8593	.8599	.8605	.8611	.8617	.8623	.8629	.8634	.8640	.8646
.63	.8652	.8658	.8664	.8669	.8675	.8681	.8687	.8692	.8698	.8704
.64	.8710	.8716	.8721	.8727	.8733	.8738	.8744	.8750	.8756	.8761
.65	.8767	.8773	.8778	.8784	.8790	.8795	.8801	.8707	.8812	.8818
.66	.8824	.8829	.8835	.8841	.8846	.8852	.8857	.8863	.8869	.8874
.67	.8880	.8885	.8891	.8896	.8902	.8908	.8913	.8919	.8924	.8930
.68	.8935	.8941	.8946	.8952	.8957	.8963	.8968	.8974	.8979	.8985
.69	.8990	.8995	.9001	.9006	.9012	.9017	.9023	.9028	.9034	.9039
.70	.9044	.9050	.9055	.9061	.9066	.9071	.9077	.9082	.9087	.9093
.71	.9098	.9103	.9109	.9114	.9119	.9125	.9130	.9135	.9141	.9146
.72	.9151	.9157	.9162	.9167	.9172	.9178	.9183	.9188	.9194	.9199
.73	.9204	.9209	.9215	.9220	.9225	.9230	.9235	.9241	.9246	.9251
.74	.9256	.9261	.9267	.9272	.9277	.9282	.9287	.9292	.9298	.9303

F. Mach Number versus Pressure Ratio - cont'd.

q_c/p	0	1	2	3	4	5	6	7	8	9
.75	.9308	.9313	.9318	.9323	.9328	.9334	.9339	.9344	.9349	.9354
.76	.9359	.9364	.9369	.9374	.9379	.9384	.9390	.9395	.9400	.9405
.77	.9410	.9415	.9420	.9425	.9430	.9435	.9440	.9445	.9450	.9455
.78	.9460	.9465	.9470	.9475	.9480	.9485	.9490	.9495	.9500	.9505
.79	.9510	.9515	.9520	.9525	.9530	.9534	.9539	.9544	.9549	.9554
.80	.9559	.9564	.9569	.9574	.9579	.9584	.9588	.9593	.9598	.9603
.81	.9608	.9613	.9618	.9623	.9627	.9632	.9637	.9642	.9647	.9652
.82	.9656	.9661	.9666	.9671	.9676	.9680	.9685	.9690	.9695	.9700
.83	.9704	.9709	.9714	.9719	.9723	.9728	.9733	.9738	.9742	.9747
.84	.9752	.9757	.9761	.9766	.9771	.9776	.9780	.9785	.9790	.9794
.85	.9799	.9804	.9808	.9813	.9818	.9823	.9827	.9832	.9837	.9841
.86	.9846	.9850	.9855	.9860	.9864	.9869	.9874	.9878	.9883	.9888
.87	.9892	.9897	.9901	.9906	.9911	.9915	.9920	.9924	.9929	.9934
.88	.9938	.9943	.9947	.9952	.9956	.9961	.9966	.9970	.9975	.9979
.89	.9984	.9988	.9993	.9997						

F. Mach Number versus Pressure Ratio - cont'd.

q_c'/p	0	1	2	3	4	5	6	7	8	9
.89					1.0001	1.0006	1.0010	1.0015	1.0019	1.0024
.90	1.0028	1.0033	1.0037	1.0042	1.0046	1.0051	1.0055	1.0060	1.0064	1.0069
.91	1.0073	1.0078	1.0082	1.0087	1.0091	1.0096	1.0100	1.0105	1.0109	1.0113
.92	1.0118	1.0122	1.0127	1.0131	1.0135	1.0140	1.0144	1.0149	1.0153	1.0157
.93	1.0162	1.0166	1.0171	1.0175	1.0179	1.0184	1.0188	1.0193	1.0197	1.0201
.94	1.0206	1.0210	1.0214	1.0219	1.0223	1.0227	1.0232	1.0236	1.0240	1.0245
.95	1.0249	1.0253	1.0258	1.0262	1.0266	1.0271	1.0275	1.0279	1.0284	1.0288
.96	1.0292	1.0297	1.0301	1.0305	1.0310	1.0314	1.0318	1.0322	1.0327	1.0331
.97	1.0335	1.0339	1.0344	1.0348	1.0352	1.0356	1.0361	1.0365	1.0369	1.0373
.98	1.0378	1.0382	1.0386	1.0390	1.0395	1.0399	1.0403	1.0407	1.0412	1.0416
.99	1.0420	1.0424	1.0428	1.0433	1.0437	1.0441	1.0445	1.0449	1.0454	1.0458
1.00	1.0462	1.0466	1.0470	1.0475	1.0479	1.0483	1.0487	1.0491	1.0495	1.0500
1.01	1.0504	1.0508	1.0512	1.0516	1.0520	1.0524	1.0529	1.0533	1.0537	1.0541
1.02	1.0545	1.0549	1.0553	1.0557	1.0562	1.0566	1.0570	1.0574	1.0578	1.0582
1.03	1.0586	1.0591	1.0595	1.0599	1.0603	1.0607	1.0611	1.0615	1.0619	1.0623
1.04	1.0627	1.0631	1.0635	1.0639	1.0644	1.0648	1.0652	1.0656	1.0660	1.0664
1.05	1.0668	1.0672	1.0676	1.0680	1.0684	1.0688	1.0692	1.0696	1.0700	1.0705
1.06	1.0709	1.0713	1.0717	1.0721	1.0725	1.0729	1.0733	1.0737	1.0741	1.0745
1.07	1.0749	1.0753	1.0757	1.0761	1.0765	1.0769	1.0773	1.0777	1.0781	1.0785
1.08	1.0789	1.0793	1.0797	1.0801	1.0805	1.0809	1.0813	1.0817	1.0820	1.0824
1.09	1.0828	1.0832	1.0836	1.0840	1.0844	1.0848	1.0852	1.0856	1.0860	1.0864
1.10	1.0868	1.0872	1.0876	1.0880	1.0884	1.0888	1.0892	1.0896	1.0900	1.0903
1.11	1.0907	1.0911	1.0915	1.0919	1.0923	1.0927	1.0931	1.0935	1.0939	1.0942
1.12	1.0946	1.0950	1.0954	1.0958	1.0962	1.0966	1.0970	1.0974	1.0978	1.0981
1.13	1.0985	1.0989	1.0993	1.0997	1.1001	1.1005	1.1009	1.1012	1.1016	1.1020
1.14	1.1024	1.1028	1.1032	1.1036	1.1039	1.1043	1.1047	1.1051	1.1055	1.1059

F. Mach Number versus Pressure Ratio - cont'd.

q_c'/p	0	1	2	3	4	5	6	7	8	9
1.15	1.1062	1.1066	1.1070	1.1074	1.1078	1.1082	1.1086	1.1089	1.1093	1.1097
1.16	1.1101	1.1105	1.1109	1.1112	1.1116	1.1120	1.1124	1.1128	1.1131	1.1135
1.17	1.1139	1.1143	1.1147	1.1150	1.1154	1.1158	1.1162	1.1166	1.1169	1.1173
1.18	1.1177	1.1181	1.1185	1.1188	1.1192	1.1196	1.1200	1.1203	1.1207	1.1211
1.19	1.1215	1.1218	1.1222	1.1226	1.1230	1.1233	1.1237	1.1241	1.1245	1.1248
1.20	1.1252	1.1256	1.1260	1.1263	1.1267	1.1271	1.1275	1.1278	1.1282	1.1286
1.21	1.1290	1.1293	1.1297	1.1301	1.1305	1.1308	1.1312	1.1316	1.1319	1.1323
1.22	1.1327	1.1331	1.1334	1.1338	1.1342	1.1345	1.1349	1.1353	1.1356	1.1360
1.23	1.1364	1.1368	1.1371	1.1375	1.1379	1.1382	1.1386	1.1390	1.1394	1.1397
1.24	1.1401	1.1405	1.1408	1.1412	1.1416	1.1419	1.1423	1.1427	1.1430	1.1434
1.25	1.1437	1.1441	1.1445	1.1448	1.1452	1.1456	1.1459	1.1463	1.1467	1.1470
1.26	1.1474	1.1478	1.1481	1.1485	1.1489	1.1492	1.1496	1.1500	1.1503	1.1507
1.27	1.1511	1.1514	1.1518	1.1521	1.1525	1.1529	1.1532	1.1536	1.1539	1.1543
1.28	1.1547	1.1550	1.1554	1.1558	1.1561	1.1565	1.1568	1.1572	1.1576	1.1579
1.29	1.1583	1.1586	1.1590	1.1594	1.1597	1.1601	1.1604	1.1608	1.1612	1.1615
1.30	1.1619	1.1622	1.1626	1.1630	1.1633	1.1637	1.1640	1.1644	1.1647	1.1651
1.31	1.1655	1.1658	1.1662	1.1665	1.1669	1.1672	1.1676	1.1680	1.1683	1.1687
1.32	1.1690	1.1694	1.1697	1.1701	1.1704	1.1708	1.1712	1.1715	1.1719	1.1722
1.33	1.1726	1.1729	1.1733	1.1736	1.1740	1.1743	1.1747	1.1750	1.1754	1.1757
1.34	1.1761	1.1765	1.1768	1.1772	1.1775	1.1779	1.1782	1.1786	1.1789	1.1793
1.35	1.1796	1.1800	1.1803	1.1807	1.1810	1.1814	1.1817	1.1821	1.1824	1.1828
1.36	1.1831	1.1835	1.1838	1.1842	1.1845	1.1849	1.1852	1.1856	1.1859	1.1863
1.37	1.1866	1.1870	1.1873	1.1877	1.1880	1.1884	1.1887	1.1891	1.1894	1.1898
1.38	1.1901	1.1905	1.1908	1.1912	1.1915	1.1918	1.1922	1.1925	1.1929	1.1932
1.39	1.1936	1.1939	1.1943	1.1946	1.1950	1.1953	1.1956	1.1960	1.1963	1.1967

F. Mach Number versus Pressure Ratio - cont'd.

q_c'/p	0	1	2	3	4	5	6	7	8	9
1.40	1.1970	1.1974	1.1977	1.1981	1.1984	1.1988	1.1991	1.1994	1.1998	1.2001
1.41	1.2005	1.2008	1.2012	1.2015	1.2018	1.2022	1.2025	1.2029	1.2032	1.2036
1.42	1.2039	1.2042	1.2046	1.2049	1.2053	1.2056	1.2059	1.2063	1.2066	1.2070
1.43	1.2073	1.2077	1.2080	1.2083	1.2087	1.2090	1.2094	1.2097	1.2101	1.2104
1.44	1.2107	1.2111	1.2114	1.2117	1.2121	1.2124	1.2128	1.2131	1.2134	1.2138
1.45	1.2141	1.2144	1.2148	1.2151	1.2155	1.2158	1.2161	1.2165	1.2168	1.2172
1.46	1.2175	1.2178	1.2182	1.2185	1.2188	1.2192	1.2195	1.2199	1.2202	1.2205
1.47	1.2209	1.2212	1.2215	1.2219	1.2222	1.2225	1.2229	1.2232	1.2235	1.2239
1.48	1.2242	1.2245	1.2249	1.2252	1.2256	1.2259	1.2262	1.2266	1.2269	1.2272
1.49	1.2276	1.2279	1.2282	1.2286	1.2289	1.2292	1.2296	1.2299	1.2302	1.2306
1.50	1.2309	1.2312	1.2316	1.2319	1.2322	1.2326	1.2329	1.2332	1.2335	1.2339
1.51	1.2342	1.2345	1.2349	1.2352	1.2355	1.2359	1.2362	1.2365	1.2369	1.2372
1.52	1.2375	1.2379	1.2382	1.2385	1.2389	1.2392	1.2395	1.2398	1.2402	1.2405
1.53	1.2408	1.2412	1.2415	1.2418	1.2421	1.2425	1.2428	1.2431	1.2435	1.2438
1.54	1.2441	1.2444	1.2448	1.2451	1.2454	1.2458	1.2461	1.2464	1.2467	1.2471
1.55	1.2474	1.2477	1.2480	1.2484	1.2487	1.2490	1.2494	1.2497	1.2500	1.2503
1.56	1.2507	1.2510	1.2513	1.2516	1.2520	1.2523	1.2526	1.2529	1.2533	1.2536
1.57	1.2539	1.2542	1.2546	1.2549	1.2552	1.2555	1.2559	1.2562	1.2565	1.2568
1.58	1.2572	1.2575	1.2578	1.2581	1.2585	1.2588	1.2591	1.2594	1.2598	1.2601
1.59	1.2604	1.2607	1.2610	1.2614	1.2617	1.2620	1.2623	1.2627	1.2630	1.2633
1.60	1.2636	1.2639	1.2643	1.2646	1.2649	1.2652	1.2656	1.2659	1.2662	1.2665
1.61	1.2668	1.2672	1.2675	1.2678	1.2681	1.2684	1.2688	1.2691	1.2694	1.2697
1.62	1.2701	1.2704	1.2707	1.2710	1.2713	1.2716	1.2720	1.2723	1.2726	1.2729
1.63	1.2732	1.2736	1.2739	1.2742	1.2745	1.2748	1.2752	1.2755	1.2758	1.2761
1.64	1.2764	1.2767	1.2771	1.2774	1.2777	1.2780	1.2783	1.2787	1.2790	1.2793

F. Mach Number versus Pressure Ratio - cont'd.

q_c'/p	0	1	2	3	4	5	6	7	8	9
1.65	1.2796	1.2799	1.2802	1.2806	1.2809	1.2812	1.2815	1.2818	1.2821	1.2825
1.66	1.2828	1.2831	1.2834	1.2837	1.2840	1.2843	1.2847	1.2850	1.2853	1.2856
1.67	1.2859	1.2862	1.2866	1.2869	1.2872	1.2875	1.2878	1.2881	1.2885	1.2888
1.68	1.2891	1.2894	1.2897	1.2900	1.2903	1.2907	1.2910	1.2913	1.2916	1.2919
1.69	1.2922	1.2925	1.2928	1.2932	1.2935	1.2938	1.2941	1.2944	1.2947	1.2950
1.70	1.2953	1.2957	1.2960	1.2963	1.2966	1.2969	1.2972	1.2975	1.2978	1.2982
1.71	1.2985	1.2988	1.2991	1.2994	1.2997	1.3000	1.3003	1.3007	1.3010	1.3013
1.72	1.3016	1.3019	1.3022	1.3025	1.3028	1.3031	1.3034	1.3038	1.3041	1.3044
1.73	1.3047	1.3050	1.3053	1.3056	1.3059	1.3062	1.3065	1.3068	1.3072	1.3075
1.74	1.3078	1.3081	1.3084	1.3087	1.3090	1.3093	1.3096	1.3099	1.3103	1.3106
1.75	1.3109	1.3112	1.3115	1.3118	1.3121	1.3124	1.3127	1.3130	1.3133	1.3136
1.76	1.3139	1.3142	1.3146	1.3149	1.3152	1.3155	1.3158	1.3161	1.3164	1.3167
1.77	1.3170	1.3173	1.3176	1.3179	1.3182	1.3185	1.3189	1.3192	1.3195	1.3198
1.78	1.3201	1.3204	1.3207	1.3210	1.3213	1.3216	1.3219	1.3222	1.3225	1.3228
1.79	1.3231	1.3234	1.3237	1.3240	1.3243	1.3246	1.3249	1.3253	1.3256	1.3259
1.80	1.3262	1.3265	1.3268	1.3271	1.3274	1.3277	1.3280	1.3283	1.3286	1.3289
1.81	1.3292	1.3295	1.3298	1.3301	1.3304	1.3307	1.3310	1.3313	1.3316	1.3319
1.82	1.3322	1.3325	1.3328	1.3331	1.3334	1.3337	1.3340	1.3343	1.3346	1.3349
1.83	1.3352	1.3355	1.3358	1.3362	1.3365	1.3368	1.3371	1.3374	1.3377	1.3380
1.84	1.3383	1.3386	1.3389	1.3392	1.3395	1.3398	1.3401	1.3404	1.3407	1.3410
1.85	1.3413	1.3416	1.3419	1.3422	1.3425	1.3428	1.3431	1.3434	1.3437	1.3440
1.86	1.3443	1.3446	1.3449	1.3452	1.3455	1.3458	1.3461	1.3463	1.3466	1.3469
1.87	1.3472	1.3475	1.3478	1.3481	1.3484	1.3487	1.3490	1.3493	1.3496	1.3499
1.88	1.3502	1.3505	1.3508	1.3511	1.3514	1.3517	1.3520	1.3523	1.3526	1.3529
1.89	1.3532	1.3535	1.3538	1.3541	1.3544	1.3547	1.3550	1.3553	1.3556	1.3559

F. Mach Number versus Pressure Ratio - cont'd.

q_c'/p	0	1	2	3	4	5	6	7	8	9
1.90	1.3562	1.3565	1.3568	1.3571	1.3573	1.3576	1.3579	1.3582	1.3585	1.3588
1.91	1.3591	1.3594	1.3597	1.3600	1.3603	1.3606	1.3609	1.3612	1.3615	1.3618
1.92	1.3621	1.3624	1.3627	1.3630	1.3632	1.3635	1.3638	1.3641	1.3644	1.3647
1.93	1.3650	1.3653	1.3656	1.3659	1.3662	1.3665	1.3668	1.3671	1.3674	1.3677
1.94	1.3680	1.3682	1.3685	1.3688	1.3691	1.3694	1.3697	1.3700	1.3703	1.3706
1.95	1.3709	1.3712	1.3715	1.3718	1.3720	1.3723	1.3726	1.3729	1.3732	1.3735
1.96	1.3738	1.3741	1.3744	1.3747	1.3750	1.3753	1.3755	1.3758	1.3761	1.3764
1.97	1.3767	1.3770	1.3773	1.3776	1.3779	1.3782	1.3785	1.3788	1.3790	1.3793
1.98	1.3796	1.3799	1.3802	1.3805	1.3808	1.3811	1.3814	1.3817	1.3819	1.3822
1.99	1.3825	1.3828	1.3831	1.3834	1.3837	1.3840	1.3843	1.3845	1.3848	1.3851
2.00	1.3854	1.3857	1.3860	1.3863	1.3866	1.3869	1.3871	1.3874	1.3877	1.3880
2.01	1.3883	1.3886	1.3889	1.3892	1.3895	1.3897	1.3900	1.3903	1.3906	1.3909
2.02	1.3912	1.3915	1.3918	1.3920	1.3923	1.3926	1.3929	1.3932	1.3935	1.3938
2.03	1.3941	1.3943	1.3946	1.3949	1.3952	1.3955	1.3958	1.3961	1.3963	1.3966
2.04	1.3969	1.3972	1.3975	1.3978	1.3981	1.3984	1.3986	1.3989	1.3992	1.3995
2.05	1.3998	1.4001	1.4004	1.4006	1.4009	1.4012	1.4015	1.4018	1.4021	1.4023
2.06	1.4026	1.4029	1.4032	1.4035	1.4038	1.4041	1.4043	1.4046	1.4049	1.4052
2.07	1.4055	1.4058	1.4060	1.4063	1.4066	1.4069	1.4072	1.4075	1.4077	1.4080
2.08	1.4083	1.4086	1.4089	1.4092	1.4095	1.4097	1.4100	1.4103	1.4106	1.4109
2.09	1.4112	1.4114	1.4117	1.4120	1.4123	1.4126	1.4128	1.4131	1.4134	1.4137
2.10	1.4140	1.4143	1.4145	1.4148	1.4151	1.4154	1.4157	1.4159	1.4162	1.4165
2.11	1.4168	1.4171	1.4174	1.4176	1.4179	1.4182	1.4185	1.4188	1.4191	1.4193
2.12	1.4196	1.4199	1.4202	1.4205	1.4207	1.4210	1.4213	1.4216	1.4219	1.4221
2.13	1.4224	1.4227	1.4230	1.4233	1.4235	1.4238	1.4241	1.4244	1.4247	1.4249
2.14	1.4252	1.4255	1.4258	1.4261	1.4263	1.4266	1.4269	1.4272	1.4275	1.4277

F. Mach Number versus Pressure Ratio - cont'd.

q_c'/p	0	1	2	3	4	5	6	7	8	9
2.15	1.4280	1.4283	1.4286	1.4289	1.4291	1.4294	1.4297	1.4300	1.4303	1.4305
2.16	1.4308	1.4311	1.4314	1.4316	1.4319	1.4322	1.4325	1.4328	1.4330	1.4333
2.17	1.4336	1.4339	1.4341	1.4344	1.4347	1.4350	1.4353	1.4355	1.4358	1.4361
2.18	1.4364	1.4366	1.4369	1.4372	1.4375	1.4378	1.4380	1.4383	1.4386	1.4389
2.19	1.4391	1.4394	1.4397	1.4400	1.4402	1.4405	1.4408	1.4411	1.4413	1.4416
2.20	1.4419	1.4422	1.4425	1.4427	1.4430	1.4433	1.4436	1.4438	1.4441	1.4444
2.21	1.4447	1.4449	1.4452	1.4455	1.4458	1.4460	1.4463	1.4466	1.4469	1.4471
2.22	1.4474	1.4477	1.4480	1.4482	1.4485	1.4488	1.4491	1.4493	1.4496	1.4499
2.23	1.4502	1.4504	1.4507	1.4510	1.4513	1.4515	1.4518	1.4521	1.4524	1.4526
2.24	1.4529	1.4532	1.4534	1.4537	1.4540	1.4543	1.4545	1.4548	1.4551	1.4554
2.25	1.4556	1.4559	1.4562	1.4565	1.4567	1.4570	1.4573	1.4575	1.4578	1.4581
2.26	1.4584	1.4586	1.4589	1.4592	1.4595	1.4597	1.4600	1.4603	1.4606	1.4608
2.27	1.4611	1.4614	1.4616	1.4619	1.4622	1.4625	1.4627	1.4630	1.4633	1.4635
2.28	1.4638	1.4641	1.4644	1.4646	1.4649	1.4652	1.4654	1.4657	1.4660	1.4663
2.29	1.4665	1.4668	1.4671	1.4673	1.4676	1.4679	1.4682	1.4684	1.4687	1.4690
2.30	1.4692	1.4695	1.4698	1.4701	1.4703	1.4706	1.4709	1.4711	1.4714	1.4717
2.31	1.4719	1.4722	1.4725	1.4727	1.4730	1.4733	1.4736	1.4738	1.4741	1.4744
2.32	1.4746	1.4749	1.4752	1.4754	1.4757	1.4760	1.4762	1.4765	1.4768	1.4771
2.33	1.4773	1.4776	1.4779	1.4781	1.4784	1.4787	1.4789	1.4792	1.4795	1.4797
2.34	1.4800	1.4803	1.4806	1.4808	1.4811	1.4814	1.4816	1.4819	1.4822	1.4824
2.35	1.4827	1.4830	1.4832	1.4835	1.4838	1.4840	1.4843	1.4846	1.4848	1.4851
2.36	1.4854	1.4856	1.4859	1.4862	1.4864	1.4867	1.4870	1.4872	1.4875	1.4878
2.37	1.4880	1.4883	1.4886	1.4888	1.4891	1.4894	1.4896	1.4899	1.4902	1.4904
2.38	1.4907	1.4910	1.4912	1.4915	1.4918	1.4920	1.4923	1.4926	1.4928	1.4931
2.39	1.4934	1.4936	1.4939	1.4942	1.4944	1.4947	1.4950	1.4952	1.4955	1.4957

F. Mach Number versus Pressure Ratio - cont'd.

q_c'/p	0	1	2	3	4	5	6	7	8	9
2.40	1.4960	1.4963	1.4965	1.4968	1.4971	1.4973	1.4976	1.4979	1.4981	1.4984
2.41	1.4987	1.4989	1.4992	1.4995	1.4997	1.5000	1.5003	1.5005	1.5008	1.5010
2.42	1.5013	1.5016	1.5018	1.5021	1.5024	1.5026	1.5029	1.5032	1.5034	1.5037
2.43	1.5039	1.5042	1.5045	1.5047	1.5050	1.5053	1.5055	1.5058	1.5061	1.5063
2.44	1.5066	1.5068	1.5071	1.5074	1.5076	1.5079	1.5082	1.5084	1.5087	1.5089
2.45	1.5092	1.5095	1.5097	1.5100	1.5103	1.5105	1.5108	1.5110	1.5113	1.5116
2.46	1.5118	1.5121	1.5124	1.5126	1.5129	1.5131	1.5134	1.5137	1.5139	1.5142
2.47	1.5144	1.5147	1.5150	1.5152	1.5155	1.5158	1.5160	1.5163	1.5165	1.5168
2.48	1.5171	1.5173	1.5176	1.5178	1.5181	1.5184	1.5186	1.5189	1.5192	1.5194
2.49	1.5197	1.5199	1.5202	1.5205	1.5207	1.5210	1.5212	1.5215	1.5218	1.5220
2.50	1.5223	1.5225	1.5228	1.5231	1.5233	1.5236	1.5238	1.5241	1.5244	1.5246
2.51	1.5249	1.5251	1.5254	1.5257	1.5259	1.5262	1.5264	1.5267	1.5270	1.5272
2.52	1.5275	1.5277	1.5280	1.5283	1.5285	1.5288	1.5290	1.5293	1.5295	1.5298
2.53	1.5301	1.5303	1.5306	1.5308	1.5311	1.5314	1.5316	1.5319	1.5321	1.5324
2.54	1.5326	1.5329	1.5332	1.5334	1.5337	1.5339	1.5342	1.5345	1.5347	1.5350
2.55	1.5352	1.5355	1.5357	1.5360	1.5363	1.5365	1.5368	1.5370	1.5373	1.5375
2.56	1.5378	1.5381	1.5383	1.5386	1.5388	1.5391	1.5394	1.5396	1.5399	1.5401
2.57	1.5404	1.5406	1.5409	1.5411	1.5414	1.5417	1.5419	1.5422	1.5424	1.5427
2.58	1.5429	1.5432	1.5435	1.5437	1.5440	1.5442	1.5445	1.5447	1.5450	1.5452
2.59	1.5455	1.5458	1.5460	1.5463	1.5465	1.5468	1.5470	1.5473	1.5475	1.5478
2.60	1.5481	1.5483	1.5486	1.5488	1.5491	1.5493	1.5496	1.5499	1.5501	1.5504
2.61	1.5506	1.5509	1.5511	1.5514	1.5516	1.5519	1.5521	1.5524	1.5526	1.5529
2.62	1.5532	1.5534	1.5537	1.5539	1.5542	1.5544	1.5547	1.5549	1.5552	1.5554
2.63	1.5557	1.5560	1.5562	1.5565	1.5567	1.5570	1.5572	1.5575	1.5577	1.5580
2.64	1.5582	1.5585	1.5588	1.5590	1.5593	1.5595	1.5598	1.5600	1.5603	1.5605

F. Mach Number versus Pressure Ratio - cont'd.

q_c'/p	0	1	2	3	4	5	6	7	8	9
2.65	1.5608	1.5610	1.5613	1.5615	1.5618	1.5620	1.5623	1.5625	1.5628	1.5631
2.66	1.5633	1.5636	1.5638	1.5641	1.5643	1.5646	1.5648	1.5651	1.5653	1.5656
2.67	1.5658	1.5661	1.5663	1.5666	1.5668	1.5671	1.5673	1.5676	1.5678	1.5681
2.68	1.5684	1.5686	1.5689	1.5691	1.5694	1.5696	1.5699	1.5701	1.5704	1.5706
2.69	1.5709	1.5711	1.5714	1.5716	1.5719	1.5721	1.5724	1.5726	1.5729	1.5731
2.70	1.5734	1.5736	1.5739	1.5741	1.5744	1.5746	1.5749	1.5751	1.5754	1.5756
2.71	1.5759	1.5761	1.5764	1.5766	1.5769	1.5771	1.5774	1.5776	1.5779	1.5781
2.72	1.5784	1.5786	1.5789	1.5791	1.5794	1.5796	1.5799	1.5801	1.5804	1.5806
2.73	1.5809	1.5811	1.5814	1.5816	1.5819	1.5821	1.5824	1.5826	1.5829	1.5831
2.74	1.5834	1.5836	1.5839	1.5841	1.5844	1.5846	1.5849	1.5851	1.5854	1.5856
2.75	1.5859	1.5861	1.5864	1.5866	1.5869	1.5871	1.5874	1.5876	1.5879	1.5881
2.76	1.5884	1.5886	1.5889	1.5891	1.5894	1.5896	1.5899	1.5901	1.5904	1.5906
2.77	1.5909	1.5911	1.5913	1.5916	1.5918	1.5921	1.5923	1.5926	1.5928	1.5931
2.78	1.5933	1.5936	1.5938	1.5941	1.5943	1.5946	1.5948	1.5951	1.5953	1.5956
2.79	1.5958	1.5960	1.5963	1.5965	1.5968	1.5970	1.5973	1.5975	1.5978	1.5980
2.80	1.5983	1.5985	1.5988	1.5990	1.5993	1.5995	1.5998	1.6000	1.6003	1.6005
2.81	1.6007	1.6010	1.6012	1.6015	1.6017	1.6020	1.6022	1.6025	1.6027	1.6030
2.82	1.6032	1.6034	1.6037	1.6039	1.6042	1.6044	1.6047	1.6049	1.6052	1.6054
2.83	1.6057	1.6059	1.6061	1.6064	1.6066	1.6069	1.6071	1.6074	1.6076	1.6079
2.84	1.6081	1.6084	1.6086	1.6089	1.6091	1.6093	1.6096	1.6098	1.6101	1.6103
2.85	1.6106	1.6108	1.6111	1.6113	1.6115	1.6118	1.6120	1.6123	1.6125	1.6128
2.86	1.6130	1.6133	1.6135	1.6137	1.6140	1.6142	1.6145	1.6147	1.6150	1.6152
2.87	1.6154	1.6157	1.6159	1.6162	1.6164	1.6167	1.6169	1.6172	1.6174	1.6176
2.88	1.6179	1.6181	1.6184	1.6186	1.6189	1.6191	1.6194	1.6196	1.6198	1.6201
2.89	1.6203	1.6206	1.6208	1.6211	1.6213	1.6215	1.6218	1.6220	1.6223	1.6225

F. Mach Number versus Pressure Ratio - cont'd.

q_c'/p	0	1	2	3	4	5	6	7	8	9
2.90	1.6228	1.6230	1.6232	1.6235	1.6237	1.6240	1.6242	1.6245	1.6247	1.6249
2.91	1.6252	1.6254	1.6257	1.6259	1.6261	1.6264	1.6266	1.6269	1.6271	1.6274
2.92	1.6276	1.6278	1.6281	1.6283	1.6286	1.6288	1.6291	1.6293	1.6295	1.6298
2.93	1.6300	1.6303	1.6305	1.6308	1.6310	1.6312	1.6315	1.6317	1.6320	1.6322
2.94	1.6324	1.6327	1.6329	1.6332	1.6334	1.6336	1.6339	1.6341	1.6344	1.6346
2.95	1.6348	1.6351	1.6353	1.6356	1.6358	1.6361	1.6363	1.6365	1.6368	1.6370
2.96	1.6373	1.6375	1.6377	1.6380	1.6382	1.6385	1.6387	1.6389	1.6392	1.6394
2.97	1.6397	1.6399	1.6401	1.6404	1.6406	1.6409	1.6411	1.6413	1.6416	1.6418
2.98	1.6421	1.6423	1.6425	1.6428	1.6430	1.6433	1.6435	1.6437	1.6440	1.6442
2.99	1.6445	1.6447	1.6449	1.6452	1.6454	1.6457	1.6459	1.6461	1.6464	1.6466
3.00	1.6468	1.6471	1.6473	1.6476	1.6478	1.6480	1.6483	1.6485	1.6488	1.6490
3.01	1.6492	1.6495	1.6497	1.6500	1.6502	1.6504	1.6507	1.6509	1.6511	1.6514
3.02	1.6516	1.6519	1.6521	1.6523	1.6526	1.6528	1.6531	1.6533	1.6535	1.6538
3.03	1.6540	1.6542	1.6545	1.6547	1.6550	1.6552	1.6554	1.6557	1.6559	1.6561
3.04	1.6564	1.6566	1.6569	1.6571	1.6573	1.6576	1.6578	1.6580	1.6583	1.6585
3.05	1.6588	1.6590	1.6592	1.6595	1.6597	1.6599	1.6602	1.6604	1.6607	1.6609
3.06	1.6611	1.6614	1.6616	1.6618	1.6621	1.6623	1.6625	1.6628	1.6630	1.6633
3.07	1.6635	1.6637	1.6640	1.6642	1.6644	1.6647	1.6649	1.6651	1.6654	1.6656
3.08	1.6659	1.6661	1.6663	1.6666	1.6668	1.6670	1.6673	1.6675	1.6677	1.6680
3.09	1.6682	1.6685	1.6687	1.6689	1.6692	1.6694	1.6696	1.6699	1.6701	1.6703
3.10	1.6706	1.6708	1.6710	1.6713	1.6715	1.6718	1.6720	1.6722	1.6725	1.6727
3.11	1.6729	1.6732	1.6734	1.6736	1.6739	1.6741	1.6743	1.6746	1.6748	1.6750
3.12	1.6753	1.6755	1.6757	1.6760	1.6762	1.6764	1.6767	1.6769	1.6772	1.6774
3.13	1.6776	1.6779	1.6781	1.6783	1.6786	1.6788	1.6790	1.6793	1.6795	1.6797
3.14	1.6800	1.6802	1.6804	1.6807	1.6809	1.6811	1.6814	1.6816	1.6818	1.6821

P. Mach Number versus Pressure Ratio - cont'd.

q_o'/p	0	1	2	3	4	5	6	7	8	9
3.15	1.6823	1.6825	1.6828	1.6830	1.6832	1.6835	1.6837	1.6839	1.6842	1.6844
3.16	1.6846	1.6849	1.6851	1.6853	1.6856	1.6858	1.6860	1.6863	1.6865	1.6867
3.17	1.6870	1.6872	1.6874	1.6877	1.6879	1.6881	1.6884	1.6886	1.6888	1.6891
3.18	1.6893	1.6895	1.6898	1.6900	1.6902	1.6905	1.6907	1.6909	1.6912	1.6914
3.19	1.6916	1.6919	1.6921	1.6923	1.6926	1.6928	1.6930	1.6933	1.6935	1.6937
3.20	1.6939	1.6942	1.6944	1.6946	1.6949	1.6951	1.6953	1.6956	1.6958	1.6960
3.21	1.6963	1.6965	1.6967	1.6970	1.6972	1.6974	1.6977	1.6979	1.6981	1.6984
3.22	1.6986	1.6988	1.6990	1.6993	1.6995	1.6997	1.7000	1.7002	1.7004	1.7007
3.23	1.7009	1.7011	1.7014	1.7016	1.7018	1.7020	1.7023	1.7025	1.7027	1.7030
3.24	1.7032	1.7034	1.7037	1.7039	1.7041	1.7044	1.7046	1.7048	1.7050	1.7053
3.25	1.7055	1.7057	1.7060	1.7062	1.7064	1.7067	1.7069	1.7071	1.7073	1.7076
3.26	1.7078	1.7080	1.7083	1.7085	1.7087	1.7090	1.7092	1.7094	1.7097	1.7099
3.27	1.7101	1.7103	1.7106	1.7108	1.7110	1.7113	1.7115	1.7117	1.7119	1.7122
3.28	1.7124	1.7126	1.7129	1.7131	1.7133	1.7136	1.7138	1.7140	1.7142	1.7145
3.29	1.7147	1.7149	1.7152	1.7154	1.7156	1.7158	1.7161	1.7163	1.7165	1.7168
3.30	1.7170	1.7172	1.7174	1.7177	1.7179	1.7181	1.7184	1.7186	1.7188	1.7190
3.31	1.7193	1.7195	1.7197	1.7200	1.7202	1.7204	1.7206	1.7209	1.7211	1.7213
3.32	1.7216	1.7218	1.7220	1.7222	1.7225	1.7227	1.7229	1.7232	1.7234	1.7236
3.33	1.7238	1.7241	1.7243	1.7245	1.7247	1.7250	1.7252	1.7254	1.7257	1.7259
3.34	1.7261	1.7263	1.7266	1.7268	1.7270	1.7272	1.7275	1.7277	1.7279	1.7282
3.35	1.7284	1.7286	1.7288	1.7291	1.7293	1.7295	1.7298	1.7300	1.7302	1.7304
3.36	1.7307	1.7309	1.7311	1.7313	1.7316	1.7318	1.7320	1.7322	1.7325	1.7327
3.37	1.7329	1.7331	1.7334	1.7336	1.7338	1.7341	1.7343	1.7345	1.7347	1.7350
3.38	1.7352	1.7354	1.7356	1.7359	1.7361	1.7363	1.7365	1.7368	1.7370	1.7372
3.39	1.7374	1.7377	1.7379	1.7381	1.7384	1.7386	1.7388	1.7390	1.7393	1.7395

F. Mach Number versus Pressure Ratio - cont'd.

q_c'/p	0	1	2	3	4	5	6	7	8	9
3.40	1.7397	1.7399	1.7402	1.7404	1.7406	1.7408	1.7411	1.7413	1.7415	1.7417
3.41	1.7420	1.7422	1.7424	1.7426	1.7429	1.7431	1.7433	1.7435	1.7438	1.7440
3.42	1.7442	1.7444	1.7447	1.7449	1.7451	1.7453	1.7456	1.7458	1.7460	1.7462
3.43	1.7465	1.7467	1.7469	1.7471	1.7474	1.7476	1.7478	1.7480	1.7483	1.7485
3.44	1.7487	1.7489	1.7492	1.7494	1.7496	1.7498	1.7501	1.7503	1.7505	1.7507
3.45	1.7509	1.7512	1.7514	1.7516	1.7518	1.7521	1.7523	1.7525	1.7527	1.7530
3.46	1.7532	1.7534	1.7536	1.7539	1.7541	1.7543	1.7545	1.7548	1.7550	1.7552
3.47	1.7554	1.7556	1.7559	1.7561	1.7563	1.7565	1.7568	1.7570	1.7572	1.7574
3.48	1.7577	1.7579	1.7581	1.7583	1.7586	1.7588	1.7590	1.7592	1.7594	1.7597
3.49	1.7599	1.7601	1.7603	1.7606	1.7608	1.7610	1.7612	1.7614	1.7617	1.7619
3.50	1.7621	1.7623	1.7626	1.7628	1.7630	1.7632	1.7634	1.7637	1.7639	1.7641
3.51	1.7643	1.7646	1.7648	1.7650	1.7652	1.7654	1.7657	1.7659	1.7661	1.7663
3.52	1.7666	1.7668	1.7670	1.7672	1.7674	1.7677	1.7679	1.7681	1.7683	1.7686
3.53	1.7688	1.7690	1.7692	1.7694	1.7697	1.7699	1.7701	1.7703	1.7706	1.7708
3.54	1.7710	1.7712	1.7714	1.7717	1.7719	1.7721	1.7723	1.7725	1.7728	1.7730
3.55	1.7732	1.7734	1.7736	1.7739	1.7741	1.7743	1.7745	1.7748	1.7750	1.7752
3.56	1.7754	1.7756	1.7759	1.7761	1.7763	1.7765	1.7767	1.7770	1.7772	1.7774
3.57	1.7776	1.7778	1.7781	1.7783	1.7785	1.7787	1.7790	1.7792	1.7794	1.7796
3.58	1.7798	1.7801	1.7803	1.7805	1.7807	1.7809	1.7812	1.7814	1.7816	1.7818
3.59	1.7820	1.7823	1.7825	1.7827	1.7829	1.7831	1.7834	1.7836	1.7838	1.7840
3.60	1.7842	1.7844	1.7847	1.7849	1.7851	1.7853	1.7855	1.7858	1.7860	1.7862
3.61	1.7864	1.7866	1.7869	1.7871	1.7873	1.7875	1.7877	1.7880	1.7882	1.7884
3.62	1.7886	1.7888	1.7891	1.7893	1.7895	1.7897	1.7899	1.7902	1.7904	1.7906
3.63	1.7908	1.7910	1.7912	1.7915	1.7917	1.7919	1.7921	1.7923	1.7926	1.7928
3.64	1.7930	1.7932	1.7934	1.7937	1.7939	1.7941	1.7943	1.7945	1.7947	1.7950

F. Mach Number versus Pressure Ratio - cont'd.

q_c'/p	0	1	2	3	4	5	6	7	8	9
3.65	1.7952	1.7954	1.7956	1.7958	1.7961	1.7963	1.7965	1.7967	1.7969	1.7971
3.66	1.7974	1.7976	1.7978	1.7980	1.7982	1.7985	1.7987	1.7989	1.7991	1.7993
3.67	1.7995	1.7998	1.8000	1.8002	1.8004	1.8006	1.8009	1.8011	1.8013	1.8015
3.68	1.8017	1.8019	1.8022	1.8024	1.8026	1.8028	1.8030	1.8032	1.8035	1.8037
3.69	1.8039	1.8041	1.8043	1.8045	1.8048	1.8050	1.8052	1.8054	1.8056	1.8058
3.70	1.8061	1.8063	1.8065	1.8067	1.8069	1.8071	1.8074	1.8076	1.8078	1.8080
3.71	1.8082	1.8085	1.8087	1.8089	1.8091	1.8093	1.8095	1.8098	1.8100	1.8102
3.72	1.8104	1.8106	1.8108	1.8110	1.8113	1.8115	1.8117	1.8119	1.8121	1.8123
3.73	1.8126	1.8128	1.8130	1.8132	1.8134	1.8136	1.8139	1.8141	1.8143	1.8145
3.74	1.8147	1.8149	1.8152	1.8154	1.8156	1.8158	1.8160	1.8162	1.8164	1.8167
3.75	1.8169	1.8171	1.8173	1.8175	1.8177	1.8180	1.8182	1.8184	1.8186	1.8188
3.76	1.8190	1.8193	1.8195	1.8197	1.8199	1.8201	1.8203	1.8205	1.8208	1.8210
3.77	1.8212	1.8214	1.8216	1.8218	1.8220	1.8223	1.8225	1.8227	1.8229	1.8231
3.78	1.8233	1.8235	1.8238	1.8240	1.8242	1.8244	1.8246	1.8248	1.8251	1.8253
3.79	1.8255	1.8257	1.8259	1.8261	1.8263	1.8266	1.8268	1.8270	1.8272	1.8274
3.80	1.8276	1.8278	1.8281	1.8283	1.8285	1.8287	1.8289	1.8291	1.8293	1.8296
3.81	1.8298	1.8300	1.8302	1.8304	1.8306	1.8308	1.8311	1.8313	1.8315	1.8317
3.82	1.8319	1.8321	1.8323	1.8325	1.8328	1.8330	1.8332	1.8334	1.8336	1.8338
3.83	1.8340	1.8343	1.8345	1.8347	1.8349	1.8351	1.8353	1.8355	1.8357	1.8360
3.84	1.8362	1.8364	1.8366	1.8368	1.8370	1.8372	1.8375	1.8377	1.8379	1.8381
3.85	1.8383	1.8385	1.8387	1.8390	1.8392	1.8394	1.8396	1.8398	1.8400	1.8402
3.86	1.8404	1.8407	1.8409	1.8411	1.8413	1.8415	1.8417	1.8419	1.8421	1.8424
3.87	1.8426	1.8428	1.8430	1.8432	1.8434	1.8436	1.8438	1.8440	1.8443	1.8445
3.88	1.8447	1.8449	1.8451	1.8453	1.8455	1.8457	1.8460	1.8462	1.8464	1.8466
3.89	1.8468	1.8470	1.8472	1.8474	1.8477	1.8479	1.8481	1.8483	1.8485	1.8487

F. Mach Number versus Pressure Ratio - cont'd.

q_c'/p	0	1	2	3	4	5	6	7	8	9
3.90	1.8489	1.8491	1.8494	1.8496	1.8498	1.8500	1.8502	1.8504	1.8506	1.8508
3.91	1.8510	1.8513	1.8515	1.8517	1.8519	1.8521	1.8523	1.8525	1.8527	1.8529
3.92	1.8532	1.8534	1.8536	1.8538	1.8540	1.8542	1.8544	1.8546	1.8548	1.8551
3.93	1.8553	1.8555	1.8557	1.8559	1.8561	1.8563	1.8565	1.8567	1.8570	1.8572
3.94	1.8574	1.8576	1.8578	1.8580	1.8582	1.8584	1.8586	1.8589	1.8591	1.8593
3.95	1.8595	1.8597	1.8599	1.8601	1.8603	1.8605	1.8607	1.8610	1.8612	1.8614
3.96	1.8616	1.8618	1.8620	1.8622	1.8624	1.8626	1.8628	1.8631	1.8633	1.8635
3.97	1.8637	1.8639	1.8641	1.8643	1.8645	1.8647	1.8649	1.8652	1.8654	1.8656
3.98	1.8658	1.8660	1.8662	1.8664	1.8666	1.8668	1.8670	1.8673	1.8675	1.8677
3.99	1.8679	1.8681	1.8683	1.8685	1.8687	1.8689	1.8691	1.8694	1.8696	1.8698
4.00	1.8700	1.8702	1.8704	1.8706	1.8708	1.8710	1.8712	1.8714	1.8717	1.8719
4.01	1.8721	1.8723	1.8725	1.8727	1.8729	1.8731	1.8733	1.8735	1.8737	1.8739
4.02	1.8742	1.8744	1.8746	1.8748	1.8750	1.8752	1.8754	1.8756	1.8758	1.8760
4.03	1.8762	1.8765	1.8767	1.8769	1.8771	1.8773	1.8775	1.8777	1.8779	1.8781
4.04	1.8783	1.8785	1.8787	1.8790	1.8792	1.8794	1.8796	1.8798	1.8800	1.8802
4.05	1.8804	1.8806	1.8808	1.8810	1.8812	1.8815	1.8817	1.8819	1.8821	1.8823
4.06	1.8825	1.8827	1.8829	1.8831	1.8833	1.8835	1.8837	1.8839	1.8841	1.8844
4.07	1.8846	1.8848	1.8850	1.8852	1.8854	1.8856	1.8858	1.8860	1.8862	1.8864
4.08	1.8866	1.8868	1.8871	1.8873	1.8875	1.8877	1.8879	1.8881	1.8883	1.8885
4.09	1.8887	1.8889	1.8891	1.8893	1.8895	1.8898	1.8900	1.8902	1.8904	1.8906
4.10	1.8908	1.8910	1.8912	1.8914	1.8916	1.8918	1.8920	1.8922	1.8924	1.8926
4.11	1.8929	1.8931	1.8933	1.8935	1.8937	1.8939	1.8941	1.8943	1.8945	1.8947
4.12	1.8949	1.8951	1.8953	1.8955	1.8957	1.8959	1.8962	1.8964	1.8966	1.8968
4.13	1.8970	1.8972	1.8974	1.8976	1.8978	1.8980	1.8982	1.8984	1.8986	1.8988
4.14	1.8990	1.8992	1.8995	1.8997	1.8999	1.9001	1.9003	1.9005	1.9007	1.9009

F. Mach Number versus Pressure Ratio - cont'd.

q_c'/p	0	1	2	3	4	5	6	7	8	9
4.15	1.9011	1.9013	1.9015	1.9017	1.9019	1.9021	1.9023	1.9025	1.9027	1.9029
4.16	1.9032	1.9034	1.9036	1.9038	1.9040	1.9042	1.9044	1.9046	1.9048	1.9050
4.17	1.9052	1.9054	1.9056	1.9058	1.9060	1.9062	1.9064	1.9066	1.9068	1.9071
4.18	1.9073	1.9075	1.9077	1.9079	1.9081	1.9083	1.9085	1.9087	1.9089	1.9091
4.19	1.9093	1.9095	1.9097	1.9099	1.9101	1.9103	1.9105	1.9107	1.9110	1.9112
4.20	1.9114	1.9116	1.9118	1.9120	1.9122	1.9124	1.9126	1.9128	1.9130	1.9132
4.21	1.9134	1.9136	1.9138	1.9140	1.9142	1.9144	1.9146	1.9148	1.9150	1.9152
4.22	1.9154	1.9156	1.9159	1.9161	1.9163	1.9165	1.9167	1.9169	1.9171	1.9173
4.23	1.9175	1.9177	1.9179	1.9181	1.9183	1.9185	1.9187	1.9189	1.9191	1.9193
4.24	1.9195	1.9197	1.9199	1.9201	1.9203	1.9205	1.9207	1.9209	1.9212	1.9214
4.25	1.9216	1.9218	1.9220	1.9222	1.9224	1.9226	1.9228	1.9230	1.9232	1.9234
4.26	1.9236	1.9238	1.9240	1.9242	1.9244	1.9246	1.9248	1.9250	1.9252	1.9254
4.27	1.9256	1.9258	1.9260	1.9262	1.9264	1.9266	1.9268	1.9270	1.9272	1.9274
4.28	1.9277	1.9279	1.9281	1.9283	1.9285	1.9287	1.9289	1.9291	1.9293	1.9295
4.29	1.9297	1.9299	1.9301	1.9303	1.9305	1.9307	1.9309	1.9311	1.9313	1.9315
4.30	1.9317	1.9319	1.9321	1.9323	1.9325	1.9327	1.9329	1.9331	1.9333	1.9335
4.31	1.9337	1.9339	1.9341	1.9343	1.9345	1.9347	1.9349	1.9351	1.9353	1.9355
4.32	1.9357	1.9359	1.9361	1.9364	1.9366	1.9368	1.9370	1.9372	1.9374	1.9376
4.33	1.9378	1.9380	1.9382	1.9384	1.9386	1.9388	1.9390	1.9392	1.9394	1.9396
4.34	1.9398	1.9400	1.9402	1.9404	1.9406	1.9408	1.9410	1.9412	1.9414	1.9416
4.35	1.9418	1.9420	1.9422	1.9424	1.9426	1.9428	1.9430	1.9432	1.9434	1.9436
4.36	1.9438	1.9440	1.9442	1.9444	1.9446	1.9448	1.9450	1.9452	1.9454	1.9456
4.37	1.9458	1.9460	1.9462	1.9464	1.9466	1.9468	1.9470	1.9472	1.9474	1.9476
4.38	1.9478	1.9480	1.9482	1.9484	1.9486	1.9488	1.9490	1.9492	1.9494	1.9496
4.39	1.9498	1.9500	1.9502	1.9504	1.9506	1.9508	1.9510	1.9512	1.9514	1.9516

F. Mach Number versus Pressure Ratio - cont'd.

q_c'/p	0	1	2	3	4	5	6	7	8	9
4.40	1.9518	1.9520	1.9522	1.9524	1.9526	1.9528	1.9530	1.9532	1.9534	1.9536
4.41	1.9538	1.9540	1.9542	1.9544	1.9546	1.9548	1.9550	1.9552	1.9554	1.9556
4.42	1.9558	1.9560	1.9562	1.9564	1.9566	1.9568	1.9570	1.9572	1.9574	1.9576
4.43	1.9578	1.9580	1.9582	1.9584	1.9586	1.9588	1.9590	1.9592	1.9594	1.9596
4.44	1.9598	1.9600	1.9602	1.9604	1.9606	1.9608	1.9610	1.9612	1.9614	1.9616
4.45	1.9618	1.9620	1.9622	1.9624	1.9626	1.9628	1.9630	1.9632	1.9634	1.9636
4.46	1.9638	1.9640	1.9642	1.9644	1.9646	1.9648	1.9650	1.9652	1.9654	1.9656
4.47	1.9658	1.9660	1.9662	1.9664	1.9666	1.9668	1.9670	1.9672	1.9674	1.9676
4.48	1.9678	1.9680	1.9682	1.9684	1.9686	1.9688	1.9690	1.9692	1.9694	1.9696
4.49	1.9698	1.9700	1.9702	1.9704	1.9706	1.9708	1.9710	1.9712	1.9714	1.9716
4.50	1.9717	1.9719	1.9721	1.9723	1.9725	1.9727	1.9729	1.9731	1.9733	1.9735
4.51	1.9737	1.9739	1.9741	1.9743	1.9745	1.9747	1.9749	1.9751	1.9753	1.9755
4.52	1.9757	1.9759	1.9761	1.9763	1.9765	1.9767	1.9769	1.9771	1.9773	1.9775
4.53	1.9777	1.9779	1.9781	1.9783	1.9785	1.9787	1.9789	1.9791	1.9793	1.9795
4.54	1.9797	1.9799	1.9801	1.9803	1.9804	1.9806	1.9808	1.9810	1.9812	1.9814
4.55	1.9816	1.9818	1.9820	1.9822	1.9824	1.9826	1.9828	1.9830	1.9832	1.9834
4.56	1.9836	1.9838	1.9840	1.9842	1.9844	1.9846	1.9848	1.9850	1.9852	1.9854
4.57	1.9856	1.9858	1.9860	1.9862	1.9864	1.9865	1.9867	1.9869	1.9871	1.9873
4.58	1.9875	1.9877	1.9879	1.9881	1.9883	1.9885	1.9887	1.9889	1.9891	1.9893
4.59	1.9895	1.9897	1.9899	1.9901	1.9903	1.9905	1.9907	1.9909	1.9911	1.9913
4.60	1.9915	1.9917	1.9919	1.9920	1.9922	1.9924	1.9926	1.9928	1.9930	1.9932
4.61	1.9934	1.9936	1.9938	1.9940	1.9942	1.9944	1.9946	1.9948	1.9950	1.9952
4.62	1.9954	1.9956	1.9958	1.9960	1.9962	1.9964	1.9966	1.9967	1.9969	1.9971
4.63	1.9973	1.9975	1.9977	1.9979	1.9981	1.9983	1.9985	1.9987	1.9989	1.9991
4.64	1.9993	1.9995	1.9997	1.9999	2.0001					

G. Mach Number, Reynolds Number Factor, and Dynamic Pressure At Various True Airspeeds and Standard Altitudes

Sea Level							
V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}	V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}
100	0.151	1.072	33.90	450	0.680	4.823	686.5
110	.166	1.179	41.02	460	.696	4.931	717.3
120	.181	1.286	48.82	470	.711	5.038	748.9
130	.197	1.393	57.29	480	.726	5.145	781.1
140	.212	1.501	66.45	490	.741	5.252	814.0
150	.227	1.608	76.28	500	.756	5.359	847.5
160	.242	1.715	86.79	510	.771	5.467	881.8
170	.257	1.822	97.97	520	.786	5.574	916.7
180	.272	1.929	109.8	530	.801	5.681	952.3
190	.287	2.037	122.4	540	.817	5.788	988.5
200	.302	2.144	135.6	550	.832	5.895	1025
210	.318	2.251	149.5	560	.847	6.002	1063
220	.333	2.358	164.1	570	.862	6.110	1101
230	.348	2.465	179.3	580	.877	6.217	1140
240	.363	2.572	195.3	590	.892	6.324	1180
250	.378	2.680	211.9	600	.907	6.431	1220
260	.393	2.787	229.2	610	.922	6.538	1261
270	.408	2.894	247.1	620	.938	6.646	1303
280	.423	3.001	265.8	630	.953	6.753	1346
290	.439	3.108	285.1	640	.968	6.860	1389
300	.454	3.216	305.1	650	.983	6.967	1432
310	.469	3.323	325.8	660	.998	7.074	1477
320	.484	3.430	347.1	670	1.013	7.182	1522
330	.499	3.537	369.2	680	1.028	7.289	1568
340	.514	3.644	391.9	690	1.043	7.396	1614
350	.529	3.752	415.3	700	1.059	7.503	1661
360	.544	3.859	439.4	710	1.074	7.610	1709
370	.560	3.966	464.1	720	1.089	7.717	1757
380	.575	4.073	489.5	730	1.104	7.825	1807
390	.590	4.180	515.6	740	1.119	7.932	1856
400	.605	4.287	542.4	750	1.134	8.039	1907
410	.620	4.395	569.9	760	1.149	8.146	1958
420	.635	4.502	598.0	770	1.164	8.253	2010
430	.650	4.609	626.8	780	1.180	8.361	2063
440	.665	4.716	656.3	790	1.195	8.468	2116
				800	1.210	8.575	2170

NOTE: In the Reynolds number factor columns of Table G on the following pages, ℓ is in feet.

G. Mach Number, Reynolds Number Factor, and Dynamic Pressure

At Various True Airspeeds and Standard Altitudes-cont'd.

5,000 Feet							
V_{knots}	M	$\frac{RN}{l} \times 10^{-6}$	q_{psf}	V_{knots}	M	$\frac{RN}{l} \times 10^{-6}$	q_{psf}
100	.154	.950	29.21	450	.692	4.274	591.5
110	.169	1.045	35.35	460	.708	4.369	618.1
120	.185	1.140	42.06	470	.723	4.464	645.3
130	.200	1.235	49.37	480	.739	4.559	673.0
140	.215	1.330	57.25	490	.754	4.654	701.4
150	.231	1.425	65.73	500	.769	4.749	730.3
160	.246	1.520	74.78	510	.785	4.844	759.8
170	.262	1.615	84.42	520	.800	4.939	789.9
180	.277	1.710	94.64	530	.816	5.034	820.5
190	.292	1.805	105.5	540	.831	5.129	851.8
200	.308	1.899	116.8	550	.846	5.224	883.6
210	.323	1.994	128.8	560	.862	5.319	916.1
220	.339	2.089	141.4	570	.877	5.414	949.1
230	.354	2.184	154.5	580	.893	5.509	982.7
240	.369	2.279	168.3	590	.908	5.604	1017
250	.385	2.374	182.6	600	.923	5.698	1052
260	.400	2.469	197.5	610	.939	5.793	1087
270	.415	2.564	212.9	620	.954	5.888	1123
280	.431	2.659	229.0	630	.969	5.983	1159
290	.446	2.754	245.7	640	.985	6.078	1196
300	.462	2.849	262.9	650	1.000	6.173	1234
310	.477	2.944	280.7	660	1.016	6.268	1272
320	.492	3.039	299.1	670	1.031	6.363	1311
330	.508	3.134	318.1	680	1.046	6.458	1351
340	.523	3.229	337.7	690	1.062	6.553	1391
350	.539	3.324	357.8	700	1.077	6.648	1431
360	.554	3.419	378.6	710	1.093	6.743	1473
370	.569	3.514	399.9	720	1.108	6.838	1514
380	.585	3.609	421.8	730	1.123	6.933	1557
390	.600	3.704	444.3	740	1.139	7.028	1600
400	.616	3.799	467.4	750	1.154	7.123	1643
410	.631	3.894	491.0	760	1.170	7.218	1687
420	.646	3.989	515.3	770	1.185	7.313	1732
430	.662	4.084	540.1	780	1.200	7.408	1777
440	.677	4.179	565.5	790	1.216	7.503	1823
				800	1.231	7.598	1870

G. Mach Number, Reynolds Number Factor, and Dynamic Pressure

At Various True Airspeeds and Standard Altitudes-cont'd.

10,000 Feet							
V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}	V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}
100	.157	.8381	25.04	450	.705	3.771	507.0
110	.172	.9219	30.29	460	.721	3.855	529.7
120	.188	1.006	36.05	470	.736	3.939	553.0
130	.204	1.089	42.31	480	.752	4.023	576.8
140	.219	1.173	49.07	490	.768	4.106	601.1
150	.235	1.257	56.33	500	.784	4.190	625.9
160	.251	1.341	64.09	510	.799	4.274	651.2
170	.266	1.425	72.35	520	.815	4.358	676.9
180	.282	1.509	81.11	530	.831	4.442	703.2
190	.298	1.592	90.38	540	.846	4.526	730.0
200	.313	1.676	100.1	550	.862	4.609	757.3
210	.329	1.760	110.4	560	.878	4.693	785.1
220	.345	1.844	121.2	570	.893	4.777	813.4
230	.360	1.928	132.4	580	.909	4.861	842.2
240	.376	2.011	144.2	590	.925	4.945	871.5
250	.392	2.095	156.5	600	.940	5.028	901.3
260	.407	2.179	169.2	610	.956	5.112	931.6
270	.423	2.263	182.5	620	.972	5.196	962.3
280	.439	2.347	196.3	630	.987	5.280	993.6
290	.454	2.430	210.5	640	1.003	5.364	1025
300	.470	2.514	225.3	650	1.019	5.447	1058
310	.486	2.598	240.6	660	1.034	5.531	1091
320	.501	2.682	256.4	670	1.050	5.615	1124
330	.517	2.766	272.6	680	1.066	5.699	1158
340	.533	2.849	289.4	690	1.081	5.783	1192
350	.548	2.933	306.7	700	1.097	5.866	1227
360	.564	3.017	324.5	710	1.113	5.950	1262
370	.580	3.101	342.8	720	1.128	6.034	1298
380	.595	3.185	361.5	730	1.144	6.118	1334
390	.611	3.268	380.8	740	1.160	6.202	1371
400	.627	3.352	400.6	750	1.175	6.285	1408
410	.642	3.436	420.8	760	1.191	6.369	1446
420	.658	3.520	441.6	770	1.207	6.453	1484
430	.674	3.604	462.9	780	1.222	6.537	1523
440	.689	3.687	484.7	790	1.238	6.621	1562
				800	1.254	6.704	1602

G. Mach Number, Reynolds Number Factor, and Dynamic Pressure

At Various True Airspeeds and Standard Altitudes-cont'd.

15,000 Feet							
V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}	V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}
100	.160	.7363	21.33	450	.719	3.313	432.0
110	.176	.8099	25.81	460	.735	3.387	451.4
120	.192	.8835	30.72	470	.750	3.460	471.2
130	.208	.9572	36.05	480	.766	3.534	491.5
140	.224	1.031	41.81	490	.782	3.608	512.2
150	.240	1.104	48.00	500	.798	3.681	533.3
160	.255	1.178	54.61	510	.814	3.755	554.8
170	.271	1.252	61.65	520	.830	3.829	576.8
180	.287	1.325	69.11	530	.846	3.902	599.2
190	.303	1.399	77.01	540	.862	3.976	622.0
200	.319	1.473	85.33	550	.878	4.050	645.3
210	.335	1.546	94.07	560	.894	4.123	669.0
220	.351	1.620	103.2	570	.910	4.197	693.1
230	.367	1.693	112.8	580	.926	4.270	717.6
240	.383	1.767	122.9	590	.942	4.344	742.5
250	.399	1.841	133.3	600	.958	4.418	767.9
260	.415	1.914	144.2	610	.974	4.491	793.7
270	.431	1.988	155.5	620	.990	4.565	820.0
280	.447	2.062	167.2	630	1.006	4.639	846.6
290	.463	2.135	179.4	640	1.022	4.712	873.7
300	.479	2.209	192.0	650	1.038	4.786	901.2
310	.495	2.282	205.0	660	1.054	4.859	929.2
320	.511	2.356	218.4	670	1.070	4.933	957.6
330	.527	2.430	232.3	680	1.086	5.007	986.4
340	.543	2.503	246.6	690	1.102	5.080	1016
350	.559	2.577	261.3	700	1.118	5.154	1045
360	.575	2.651	276.5	710	1.134	5.228	1075
370	.591	2.724	292.0	720	1.150	5.301	1106
380	.607	2.798	308.0	730	1.166	5.375	1137
390	.623	2.871	324.4	740	1.182	5.448	1168
400	.639	2.945	341.3	750	1.198	5.522	1200
410	.655	3.019	358.6	760	1.214	5.596	1232
420	.671	3.092	376.3	770	1.230	5.669	1265
430	.687	3.166	394.4	780	1.245	5.743	1298
440	.703	3.240	413.0	790	1.261	5.817	1331
				800	1.277	5.890	1365

G. Mach Number, Reynolds Number Factor, and Dynamic Pressure

At Various True Airspeeds and Standard Altitudes-cont'd.

20,000 Feet							
V_{knots}	M	$\frac{RN}{\delta}$ x 10^{-6}	q_{psf}	V_{knots}	M	$\frac{RN}{\delta}$ x 10^{-6}	q_{psf}
100	.163	.6438	18.06	450	.733	2.897	365.8
110	.179	.7082	21.86	460	.749	2.961	382.2
120	.195	.7725	26.01	470	.765	3.026	399.0
130	.212	.8369	30.53	480	.782	3.090	416.2
140	.228	.9013	35.40	490	.798	3.154	433.7
150	.244	.9657	40.64	500	.814	3.219	451.6
160	.261	1.030	46.24	510	.830	**3.283**	469.8
170	.277	1.094	52.20	520	.847	3.348	488.4
180	.293	1.159	58.52	530	.863	3.412	507.4
190	.309	1.223	65.21	540	.879	3.476	526.7
200	.326	1.288	72.25	550	.896	3.541	546.4
210	.342	1.352	79.66	560	.912	3.605	566.4
220	.358	1.416	87.42	570	.928	3.670	586.9
230	.375	1.481	95.55	580	.944	3.734	607.6
240	.391	1.545	104.0	590	.961	3.798	628.8
250	.407	1.609	112.9	600	.977	3.863	650.3
260	.423	1.674	122.1	610	.993	3.927	672.1
270	.440	1.738	131.7	620	1.010	3.991	694.3
280	.456	1.803	141.6	630	1.026	4.056	716.9
290	.472	1.867	151.9	640	1.042	4.120	739.8
300	.488	1.931	162.6	650	1.058	4.185	763.1
310	.505	1.996	173.6	660	1.075	4.249	786.8
320	.521	2.060	185.0	670	1.091	4.313	810.8
330	.537	2.124	196.7	680	1.107	4.378	835.2
340	.554	2.189	208.8	690	1.124	4.442	**860.0**
350	.570	2.253	221.3	700	1.140	4.506	885.1
360	.586	2.318	234.1	710	1.156	4.571	910.5
370	.602	2.382	247.3	720	1.172	4.635	936.4
380	.619	2.446	260.8	730	1.189	4.700	962.6
390	.635	2.511	274.7	740	1.205	4.764	989.1
400	.651	2.575	289.0	750	1.221	4.828	1016
410	.668	2.639	303.6	760	1.237	4.893	1043
420	.684	2.704	318.6	770	1.254	4.957	1071
430	.700	2.768	**334.0**	780	**1.270**	5.021	1099
440	.716	2.833	349.7	790	1.286	5.086	1127
				800	1.303	5.150	1156

G. Mach Number, Reynolds Number Factor, and Dynamic Pressure

At Various True Airspeeds and Standard Altitudes-cont'd.

25,000 Feet							
V_{knots}	M	$\frac{RN}{l} \times 10^{-6}$	q_{psf}	V_{knots}	M	$\frac{RN}{l} \times 10^{-6}$	q_{psf}
100	.166	.5600	15.19	450	.748	2.520	307.6
110	.183	.6161	18.38	460	.764	2.576	321.4
120	.199	.6721	21.88	470	.781	2.632	335.6
130	.216	.7281	25.67	480	.798	2.688	350.0
140	.233	.7841	29.77	490	.814	2.744	364.7
150	.249	.8401	34.18	500	.831	2.800	379.8
160	.266	.8961	38.89	510	.847	2.856	395.1
170	.282	.9521	43.90	520	.864	2.912	410.8
180	.299	1.008	49.22	530	.881	2.968	426.7
190	.316	1.064	54.84	540	.897	3.024	**443.0**
200	.332	1.120	60.76	550	.914	3.080	**459.5**
210	.349	1.176	66.99	560	.931	3.136	476.4
220	.366	1.232	73.53	570	.947	3.192	493.6
230	.382	1.288	80.36	580	.964	3.248	511.0
240	.399	1.344	87.50	590	.980	3.304	528.8
250	.415	1.400	**94.95**	600	.997	3.360	546.9
260	.432	1.456	102.7	610	1.014	3.416	565.3
270	.449	1.512	110.7	620	1.030	3.472	**584.0**
280	.465	1.568	119.1	630	1.047	3.528	602.9
290	.482	1.624	127.8	640	1.064	3.584	622.2
300	.499	1.680	136.7	650	1.080	3.640	641.8
310	.515	1.736	**146.0**	660	1.097	3.696	661.7
320	.532	1.792	155.6	670	1.113	3.752	681.9
330	.548	1.848	165.4	680	1.130	3.808	702.4
340	.565	1.904	175.6	690	1.147	3.864	723.3
350	.582	1.960	186.1	700	1.163	3.920	744.4
360	.598	2.016	196.9	710	1.180	3.976	765.8
370	.615	2.072	**208.0**	720	1.196	4.032	787.5
380	.631	2.128	219.4	730	1.213	4.088	809.5
390	.648	2.184	231.1	740	1.230	4.144	831.9
400	.665	2.240	243.1	750	1.246	4.200	854.5
410	.681	2.296	255.4	760	1.263	4.256	877.4
420	.698	2.352	**268.0**	770	1.280	4.312	900.7
430	.715	2.408	280.9	780	1.296	4.368	924.2
440	.731	2.464	294.1	790	1.313	4.424	948.1
				800	1.329	4.480	972.2

G. Mach Number, Reynolds Number Factor, and Dynamic Pressure

At Various True Airspeeds and Standard Altitudes-cont'd.

30,000 Feet							
V_{knots}	M	$\frac{RN}{l}$ x 10^{-6}	q_{psf}	V_{knots}	M	$\frac{RN}{l}$ x 10^{-6}	q_{psf}
100	.170	.4845	12.68	450	.764	2.180	256.8
110	.187	.5330	15.35	460	.781	2.229	**268.4**
120	.204	.5814	18.26	470	.798	2.277	280.2
130	.221	.6299	21.43	480	.815	2.326	292.2
140	.238	.6783	24.86	490	.832	2.374	304.5
150	.255	.7268	28.54	500	.849	2.423	317.1
160	.272	.7752	32.47	510	.866	2.471	329.9
170	.289	.8237	36.65	520	.883	2.520	**343.0**
180	.306	.8721	41.09	530	**.900**	2.568	356.3
190	.322	.9206	45.79	540	.917	2.616	369.8
200	.339	.9690	50.73	550	.934	2.665	383.7
210	.356	1.017	55.93	560	**.950**	2.713	397.7
220	.373	1.066	61.39	570	.967	2.762	412.1
230	.390	1.114	67.09	580	.984	2.810	426.7
240	.407	1.163	73.06	590	1.001	2.859	441.5
250	.424	1.211	79.27	600	1.018	2.907	456.6
260	.441	1.260	85.74	610	1.035	2.956	471.9
270	.458	1.308	92.46	620	1.052	3.004	487.5
280	.475	1.357	99.44	630	1.069	3.052	503.4
290	.492	1.405	106.7	640	1.086	3.101	519.5
300	.509	1.454	114.1	650	1.103	3.149	535.9
310	.526	1.502	121.9	660	1.120	3.198	552.5
320	.543	1.550	129.9	670	1.137	3.246	569.4
330	.560	1.599	138.1	680	1.154	3.295	586.5
340	.577	1.647	146.6	690	1.171	3.343	603.9
350	.594	1.696	155.4	700	1.188	3.392	621.5
360	.611	1.744	164.4	710	1.205	3.440	639.4
370	.628	1.793	173.6	720	1.222	3.489	657.5
380	.645	1.841	183.1	730	1.239	3.537	675.9
390	.662	1.890	192.9	740	1.256	3.585	694.5
400	.679	1.938	202.9	750	1.273	3.634	713.4
410	.696	1.987	213.2	760	1.290	3.682	732.6
420	.713	2.035	**223.7**	770	1.307	3.731	**752.0**
430	.730	2.083	234.5	780	1.324	3.779	771.7
440	.747	2.132	245.5	790	1.341	3.828	791.6
				800	1.358	3.876	811.7

G. Mach Number, Reynolds Number Factor, and Dynamic Pressure

At Various True Airspeeds and Standard Altitudes-cont'd.

35,000 Feet							
V_{knots}	M	$\frac{RN}{l} \times 10^{-6}$	q_{psf}	V_{knots}	M	$\frac{RN}{l} \times 10^{-6}$	q_{psf}
100	.174	.4167	10.50	450	.781	1.875	212.7
110	.191	.4583	12.71	460	.798	1.917	222.3
120	.208	.5000	15.13	470	.816	1.958	232.1
130	.226	.5417	17.75	480	.833	2.000	242.0
140	.243	.5833	20.59	490	.850	2.042	252.2
150	.260	.6250	23.64	500	.868	2.083	262.6
160	.278	.6667	26.89	510	.885	2.125	273.2
170	.295	.7083	30.36	520	.902	2.167	284.1
180	.312	.7500	34.04	530	.920	2.208	295.1
190	.330	.7917	37.92	540	.937	2.250	306.3
200	.347	.8333	42.02	550	.954	2.292	317.8
210	.364	.8750	46.33	560	.972	2.333	329.4
220	.382	.9167	50.84	570	.989	2.375	341.3
230	.399	.9583	55.57	580	1.006	2.417	353.4
240	.416	1.000	60.51	590	1.024	2.458	365.7
250	.434	1.042	65.66	600	1.041	2.500	378.2
260	.451	1.083	71.01	610	1.059	2.542	390.9
270	.469	1.125	76.58	620	1.076	2.583	403.8
280	.486	1.167	82.36	630	1.093	2.625	416.9
290	.503	1.208	88.35	640	1.111	2.667	430.3
300	.521	1.250	94.54	650	1.128	2.708	443.8
310	.538	1.292	**101.0**	660	1.145	2.750	457.6
320	.555	1.333	107.6	670	1.163	2.792	471.6
330	.573	1.375	114.4	680	1.180	2.833	485.7
340	.590	1.417	121.4	690	1.197	2.875	500.1
350	.607	1.458	128.7	700	1.215	2.917	514.7
360	.625	1.500	136.1	710	1.232	2.958	529.5
370	.642	1.542	143.8	720	1.249	3.000	544.6
380	.659	1.583	151.7	730	1.267	3.042	559.8
390	.677	1.625	159.8	740	1.284	3.083	575.2
400	.694	1.667	168.1	750	1.301	3.125	590.9
410	.711	1.708	176.6	760	1.319	3.167	606.8
420	.729	1.750	185.3	770	1.336	3.208	622.8
430	.746	1.792	194.2	780	1.354	3.250	639.1
440	.764	1.833	203.4	790	1.371	3.292	655.6
				800	1.388	3.333	672.3

G. Mach Number, Reynolds Number Factor, and Dynamic Pressure At Various True Airspeeds and Standard Altitudes-cont'd.

40,000 Feet							
V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}	V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}
100	.174	.3338	8.345	450	.785	1.502	**169.0**
110	.192	.3672	10.10	460	.802	1.536	176.6
120	.209	**.4006**	12.02	470	.820	1.569	184.3
130	.227	.4340	14.10	480	.837	1.602	192.3
140	.244	.4674	16.36	490	.855	1.636	200.4
150	.262	.5007	18.78	500	.872	**1.669**	208.6
160	.279	.5341	21.36	510	.889	1.703	217.1
170	.296	.5675	24.12	520	.907	1.736	225.7
180	.314	.6009	27.04	530	.924	1.769	234.4
190	.331	.6343	30.13	540	.942	1.803	243.4
200	.349	.6677	33.38	550	.959	1.836	252.4
210	.366	**.7010**	36.80	560	.977	1.869	261.7
220	.384	.7344	40.39	570	.994	1.903	271.1
230	.401	.7678	44.15	580	1.011	1.936	280.7
240	.419	.8012	48.07	590	1.029	1.970	290.5
250	.436	.8346	52.16	600	1.046	2.003	300.4
260	.453	.8680	56.41	610	1.064	2.036	310.5
270	.471	.9013	60.84	620	1.081	2.070	320.8
280	.488	.9347	65.43	630	1.099	2.103	331.2
290	.506	.9681	70.18	640	1.116	2.137	341.8
300	.523	1.001	75.11	650	1.134	2.170	352.6
310	.541	1.035	80.20	660	1.151	2.203	363.5
320	.558	1.068	85.46	670	1.168	2.237	374.6
330	.575	1.102	90.88	680	1.186	2.270	385.9
340	.593	1.135	96.47	690	1.203	2.303	397.3
350	.610	1.168	102.2	700	1.221	2.337	408.9
360	.628	1.202	108.2	710	1.238	2.370	420.7
370	.645	1.235	114.2	720	1.256	2.404	432.6
380	.663	1.269	120.5	730	1.273	2.437	444.7
390	.680	1.302	126.9	740	1.291	2.470	**457.0**
400	.698	1.335	133.5	750	1.308	2.504	469.4
410	.715	1.369	140.3	760	1.325	2.537	482.0
420	.732	1.402	147.2	770	1.343	2.570	494.8
430	.750	1.435	154.3	780	1.360	2.604	507.7
440	.767	1.469	161.6	790	1.378	2.637	520.8
				800	**1.395**	2.671	534.1

G. Mach Number, Reynolds Number Factor, and Dynamic Pressure

At Various True Airspeeds and Standard Altitudes-cont'd.

45,000 Feet							
V_{knots}	M	$\frac{RN}{\delta}$ x 10^{-6}	q_{psf}	V_{knots}	M	$\frac{RN}{\delta}$ x 10^{-6}	q_{psf}
100	.174	.2625	**6.562**	450	.785	1.181	132.9
110	.192	.2888	7.941	460	.802	1.208	138.9
120	.209	.3150	9.450	470	.820	1.234	**145.0**
130	.227	.3413	11.09	480	.837	1.260	151.2
140	.244	.3675	12.86	490	.855	1.286	157.6
150	.262	.3938	14.77	500	.872	1.313	164.1
160	.279	.4200	16.80	510	.889	1.339	170.7
170	.296	.4463	18.97	520	.907	1.365	177.5
180	.314	.4725	21.26	530	.924	1.391	184.3
190	.331	.4988	23.69	540	.942	1.418	191.4
200	.349	.5250	26.25	550	.959	1.444	198.5
210	.366	.5513	28.94	560	.977	1.470	205.8
220	.384	.5775	31.76	570	.994	1.496	213.2
230	.401	.6038	34.72	580	1.011	1.523	220.8
240	.419	.6300	37.80	590	1.029	1.549	228.4
250	.436	.6563	41.02	600	1.046	1.575	**236.3**
260	.453	.6825	44.36	610	1.064	1.601	244.2
270	.471	.7088	47.84	620	1.081	1.628	252.3
280	.488	.7350	51.45	630	**1.099**	1.654	260.5
290	.506	.7613	55.19	640	1.116	1.680	268.8
300	.523	.7875	59.06	650	1.134	1.706	277.3
310	.541	.8138	63.07	660	1.151	1.733	285.9
320	.558	.8400	67.20	670	1.168	1.759	294.6
330	.575	.8663	71.47	680	1.186	1.785	303.5
340	.593	.8925	75.86	690	1.203	1.811	312.4
350	.610	.9188	80.39	700	**1.221**	1.838	321.6
360	.628	.9451	85.05	710	1.238	1.864	330.8
370	.645	.9713	89.84	720	1.256	1.890	340.2
380	.663	.9976	94.76	730	1.273	1.916	349.7
390	.680	1.024	99.82	740	1.291	1.943	359.4
400	.698	1.050	105.0	750	1.308	1.969	369.1
410	.715	1.076	110.3	760	1.325	1.995	379.1
420	.732	1.103	115.8	770	1.343	2.021	389.1
430	.750	1.129	121.3	780	1.360	2.048	399.3
440	.767	1.155	**127.0**	790	1.378	2.074	409.6
				800	1.395	2.100	420.0

G. Mach Number, Reynolds Number Factor, and Dynamic Pressure

At Various True Airspeeds and Standard Altitudes-cont'd.

50,000 Feet							
V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}	V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}
100	.174	.2064	5.161	450	.785	.9290	104.5
110	.192	.2271	6.244	460	.802	.9496	109.2
120	.209	.2477	7.431	470	.820	.9703	114.0
130	.227	.2684	8.722	480	.837	.9909	118.9
140	.244	.2890	10.12	490	.855	1.012	123.9
150	.262	.3097	11.61	500	.872	1.032	129.0
160	.279	.3303	13.21	510	.889	1.053	134.2
170	.296	.3509	14.91	520	.907	1.073	139.5
180	.314	.3716	16.72	530	.924	1.094	145.0
190	.331	.3922	18.63	540	.942	1.115	150.5
200	.349	.4129	20.64	550	.959	1.135	156.1
210	.366	.4335	22.76	560	.977	1.156	161.8
220	.384	.4542	24.98	570	.994	1.177	167.7
230	.401	.4748	27.30	580	1.011	1.197	173.6
240	.419	.4954	29.73	590	1.029	1.218	179.6
250	.436	.5161	32.25	600	1.046	1.239	185.8
260	.453	.5367	34.89	610	1.064	1.259	192.0
270	.471	.5574	37.62	620	1.081	1.280	198.4
280	.488	.5780	40.46	630	1.099	1.301	204.8
290	.506	.5987	43.40	640	1.116	1.321	211.4
300	.523	.6193	46.45	650	1.134	1.342	218.0
310	.541	.6400	49.59	660	1.151	1.362	224.8
320	.558	.6606	52.85	670	1.168	1.383	231.7
330	.575	.6812	56.20	680	1.186	1.404	238.6
340	.593	.7019	59.66	690	1.203	1.424	245.7
350	.610	.7225	63.22	700	1.221	1.445	252.9
360	.628	.7432	66.88	710	1.238	1.466	260.2
370	.645	.7638	70.65	720	1.256	1.486	267.5
380	.663	.7845	74.52	730	1.273	1.507	275.0
390	.680	.8051	78.49	740	1.291	1.528	282.6
400	.698	.8257	82.57	750	1.308	1.548	290.3
410	.715	.8464	86.75	760	1.325	1.569	298.1
420	.732	.8670	91.03	770	1.343	1.590	306.0
430	.750	.8877	95.42	780	1.360	1.610	314.0
440	.767	.9083	99.91	790	1.378	1.631	322.1
				800	1.395	1.651	330.3

G. Mach Number, Reynolds Number Factor, and Dynamic Pressure

At Various True Airspeeds and Standard Altitudes-cont'd.

55,000 Feet							
V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}	V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}
100	.174	.1623	4.058	450	.785	.7305	82.18
110	.192	.1786	**4.910**	460	.802	.7467	85.87
120	.209	.1948	5.844	470	.820	.7630	89.65
130	.227	.2110	**6.858**	480	.837	.7792	93.50
140	.244	.2273	7.954	490	.855	.7954	97.44
150	.262	.2435	9.131	500	.872	.8117	101.5
160	.279	.2597	10.39	510	.889	.8279	105.6
170	.296	.2760	11.73	520	.907	.8441	109.7
180	.314	.2922	13.15	530	.924	.8604	**114.0**
190	.331	.3084	14.65	540	.942	.8766	118.3
200	.349	.3247	16.23	550	.959	.8928	112.8
210	.366	.3409	17.90	560	.977	.9091	127.3
220	.384	.3571	19.64	570	.994	.9253	131.9
230	.401	.3734	21.47	580	1.011	.9415	136.5
240	.419	.3896	23.38	590	1.029	.9578	141.3
250	.436	.4058	25.36	600	1.046	.9740	146.1
260	.453	.4221	27.43	610	1.064	.9902	151.0
270	.471	.4383	29.58	620	1.081	1.006	**156.0**
280	.488	.4545	31.82	630	1.099	1.023	161.1
290	.506	.4708	34.13	640	1.116	1.039	166.2
300	.523	.4870	36.52	650	**1.134**	1.055	171.5
310	.541	.5032	39.00	660	1.151	1.071	176.8
320	.558	.5195	41.56	670	1.168	**1.088**	182.2
330	.575	.5357	44.19	680	1.186	1.104	187.7
340	.593	.5519	46.91	690	1.203	1.120	193.2
350	.610	**.5682**	49.71	700	1.221	1.136	198.9
360	.628	.5844	52.60	710	1.238	1.153	204.6
370	.645	**.6006**	55.56	720	1.256	1.169	210.4
380	.663	.6169	58.60	730	1.273	1.185	216.3
390	.680	**.6331**	61.73	740	**1.291**	1.201	222.2
400	.698	.6493	64.93	750	1.308	1.218	228.3
410	.715	.6656	68.22	760	1.325	1.234	234.4
420	.732	.6818	71.59	770	1.343	1.250	240.6
430	.750	.6980	75.04	780	1.360	1.266	246.9
440	.767	.7143	78.57	790	1.378	1.282	253.3
				800	1.395	1.299	259.7

G. Mach Number, Reynolds Number Factor, and Dynamic Pressure

At Various True Airspeeds and Standard Altitudes-cont'd.

60,000 Feet							
V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}	V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}
100	.174	.1277	3.191	450	.785	.5745	64.62
110	.192	.1404	3.861	460	.802	.5872	67.53
120	.209	.1532	4.595	470	.820	.6000	70.50
130	.227	.1660	5.393	480	.837	.6128	73.53
140	.244	.1787	6.255	490	.855	.6255	76.62
150	.262	.1915	7.180	500	.872	.6383	79.78
160	.279	.2043	8.170	510	.889	.6511	83.01
170	.296	.2170	9.223	520	.907	.6638	86.29
180	.314	.2298	10.34	530	.924	.6766	89.64
190	.331	.2426	11.52	540	.942	.6894	93.06
200	.349	.2553	12.77	550	.959	.7021	96.54
210	.366	.2681	14.07	560	.977	.7149	100.1
220	.384	.2809	15.45	570	.994	.7277	103.7
230	.401	.2936	16.88	580	1.011	.7404	107.4
240	.419	.3064	18.38	590	1.029	.7532	111.1
250	.436	.3191	19.95	600	1.046	.7660	114.9
260	.453	.3319	21.57	610	1.064	.7787	118.7
270	.471	.3447	23.26	620	1.081	.7915	122.7
280	.488	.3574	25.02	630	1.099	.8043	**126.7**
290	.506	.3702	**26.84**	640	1.116	.8170	130.7
300	.523	.3830	28.72	650	1.134	.8298	134.8
310	.541	.3957	30.67	660	1.151	.8426	139.0
320	.558	.4085	32.68	670	1.168	.8553	143.3
330	.575	.4213	34.75	680	1.186	.8681	147.6
340	.593	.4340	36.89	690	1.203	.8809	151.9
350	.610	.4468	39.09	700	1.221	.8936	156.4
360	.628	.4596	41.36	710	1.238	.9064	160.9
370	.645	.4723	43.69	720	1.256	.9192	165.4
380	.663	.4851	46.08	730	1.273	.9319	170.1
390	.680	.4979	48.54	740	1.291	.9447	174.8
400	.698	.5106	51.06	750	1.308	.9574	179.5
410	.715	.5234	53.65	760	1.325	.9702	184.3
420	.732	.5362	56.29	770	1.343	.9830	189.2
430	.750	.5489	59.01	780	1.360	.9957	194.2
440	.767	.5617	61.78	790	1.378	1.009	199.2
				800	1.395	1.021	204.2

G. Mach Number, Reynolds Number Factor, and Dynamic Pressure

At Various True Airspeeds and Standard Altitudes-cont'd.

65,000 Feet							
V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}	V_{knots}	M	$\frac{RN}{\ell} \times 10^{-6}$	q_{psf}
100	.174	.1004	2.510	450	.785	.4517	50.82
110	.192	.1104	**3.036**	460	.802	.4618	53.10
120	.209	.1205	3.614	470	.820	.4718	55.44
130	.227	.1305	4.241	480	.837	.4819	57.82
140	.244	.1405	4.919	490	.855	.4919	60.25
150	.262	.1506	**5.646**	500	.872	.5019	62.74
160	.279	.1606	6.424	510	.889	.5120	65.27
170	.296	.1707	7.253	520	.907	.5220	67.86
180	.314	.1807	8.131	530	.924	.5321	70.49
190	.331	.1907	9.059	540	.942	.5421	73.18
200	.349	.2008	10.04	550	.959	.5521	75.91
210	.366	.2108	11.07	560	.977	.5622	78.70
220	.384	.2209	12.15	570	.994	.5722	**81.53**
230	.401	.2309	13.28	580	1.011	.5823	84.42
240	.419	.2409	14.45	590	1.029	.5923	87.36
250	.436	.2510	15.68	600	1.046	.6023	90.34
260	.453	.2610	16.96	610	1.064	.6124	93.38
270	.471	.2710	18.29	620	1.081	.6224	96.47
280	.488	.2811	19.67	630	1.099	.6324	99.60
290	.506	.2911	**21.11**	640	1.116	.6425	102.8
300	.523	.3012	22.59	650	1.134	.6525	106.0
310	.541	.3112	24.12	660	**1.151**	.6626	109.3
320	.558	.3212	25.70	670	1.168	.6726	112.7
330	.575	.3313	27.33	680	1.186	.6826	116.0
340	.593	.3413	29.01	690	1.203	.6927	119.5
350	.610	.3514	30.74	700	1.221	.7027	**123.0**
360	.628	.3614	32.52	710	1.238	.7128	126.5
370	.645	.3714	34.36	720	1.256	.7228	130.1
380	.663	.3815	36.24	730	1.273	.7328	133.7
390	.680	.3915	38.17	740	1.291	.7429	137.4
400	.698	.4016	40.15	750	1.308	.7529	141.2
410	.715	.4116	42.19	760	1.325	.7630	**145.0**
420	.732	.4216	44.27	770	1.343	.7730	148.8
430	.750	.4317	46.40	780	1.360	.7830	152.7
440	.767	.4417	48.58	790	1.378	.7931	156.6
				800	1.395	.8031	160.6

FIG. 1 PROPERTIES OF THE STANDARD ATMOSPHERE

FIG. 2 STANDARD ATMOSPHERE DENSITY RATIO

FIG.3 DENSITY AND PRESSURE ALTITUDE CONVERSION CHART

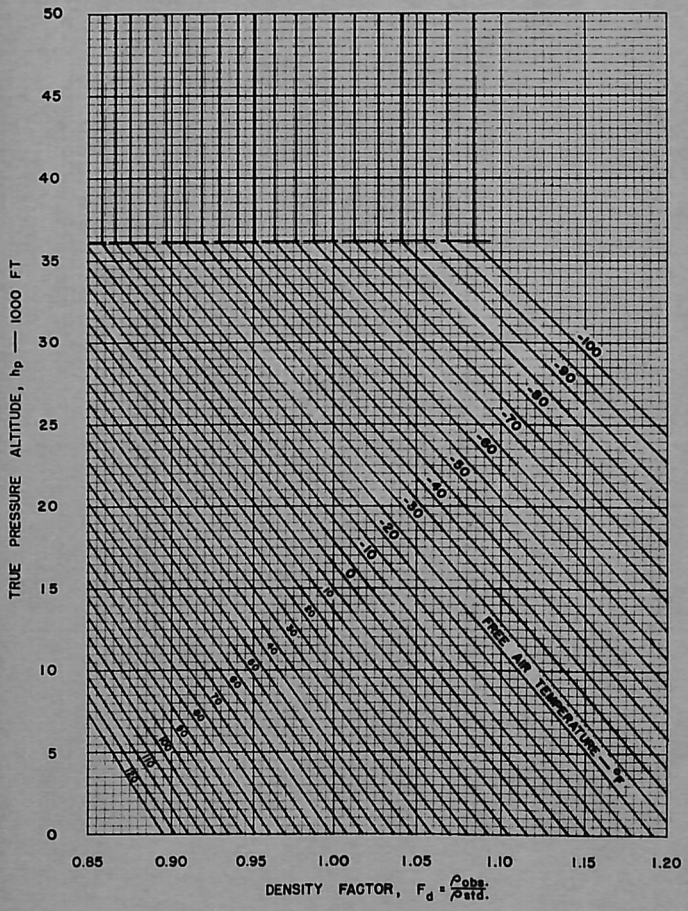


FIG. 4 DENSITY FACTOR CHART

FIG. 5A$_8$ REYNOLDS NUMBER CHART

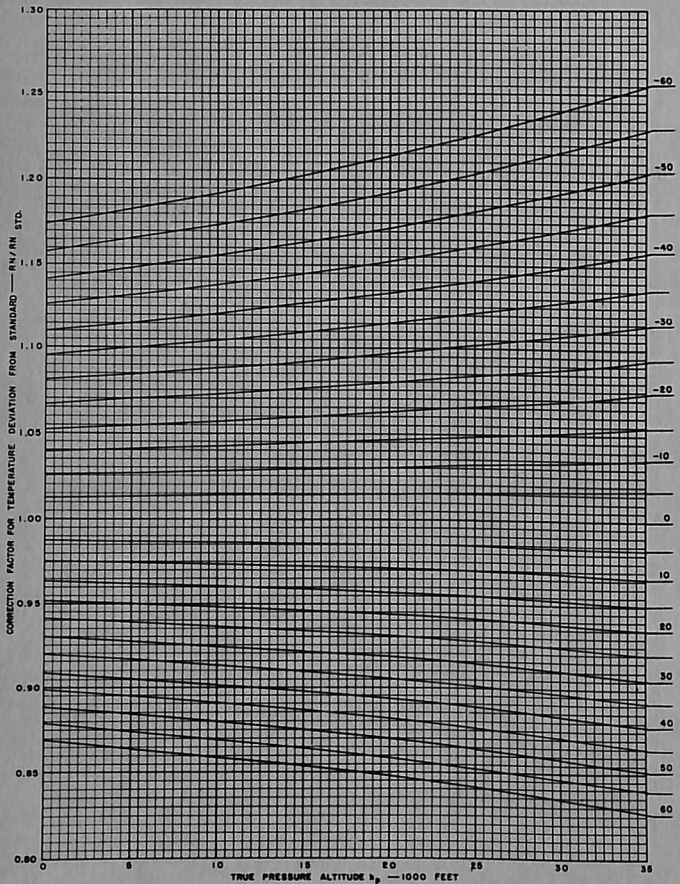


FIG. $5B_8$ REYNOLDS NUMBER TEMPERATURE CORRECTION FACTOR

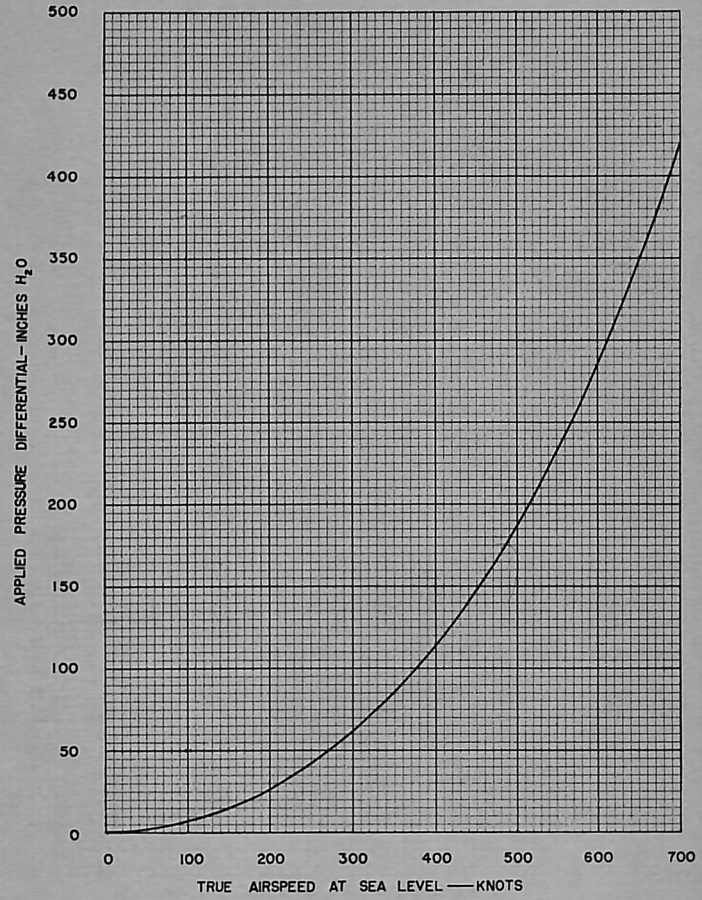


FIG. 6A$_B$ AIRSPEED INDICATOR CALIBRATION

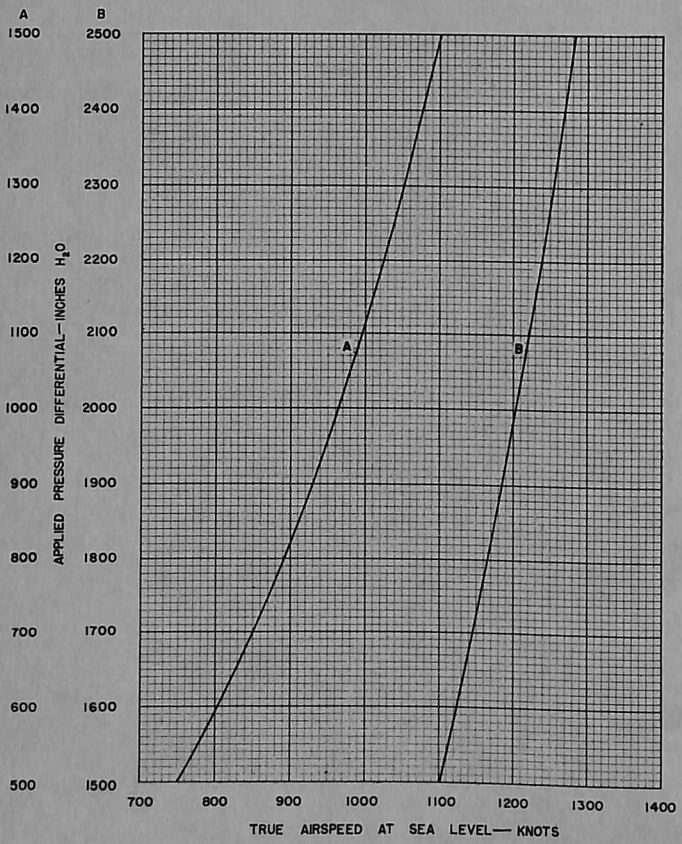


FIG. 6 B_B AIRSPEED INDICATOR CALIBRATION

FIG.7 SPEED OF SOUND

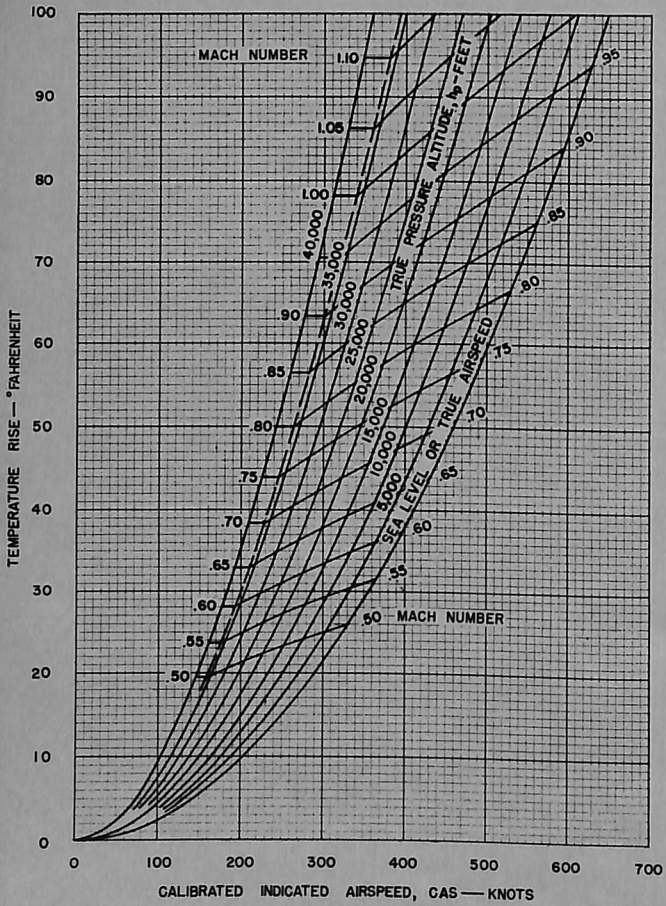


FIG. 8A$_D$ AIR TEMPERATURE RISE DUE TO ADIABATIC COMPRESSION

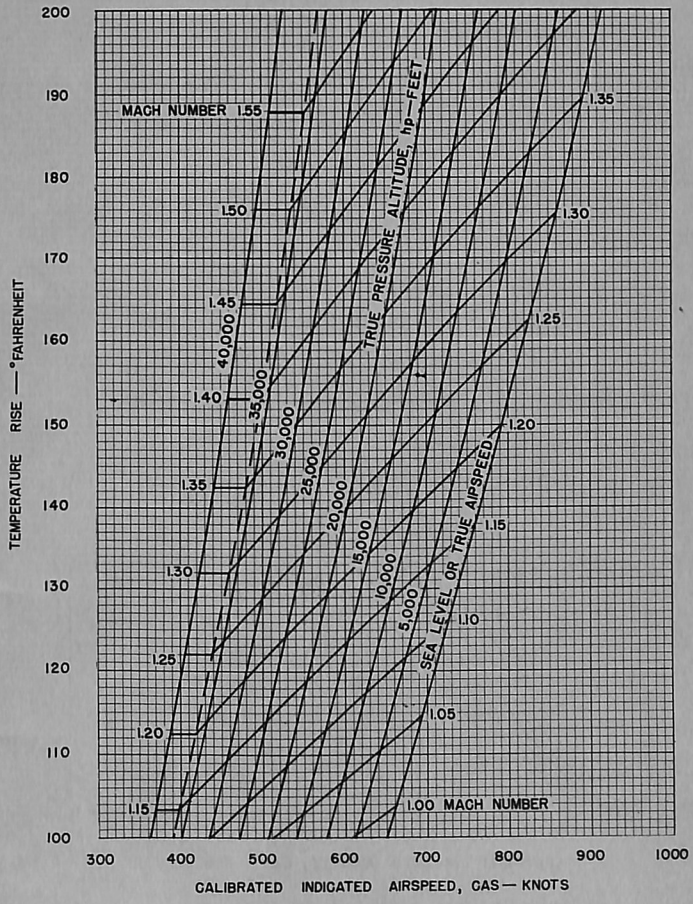


FIG. 8 B_D AIR TEMPERATURE RISE DUE TO ADIABATIC COMPRESSION

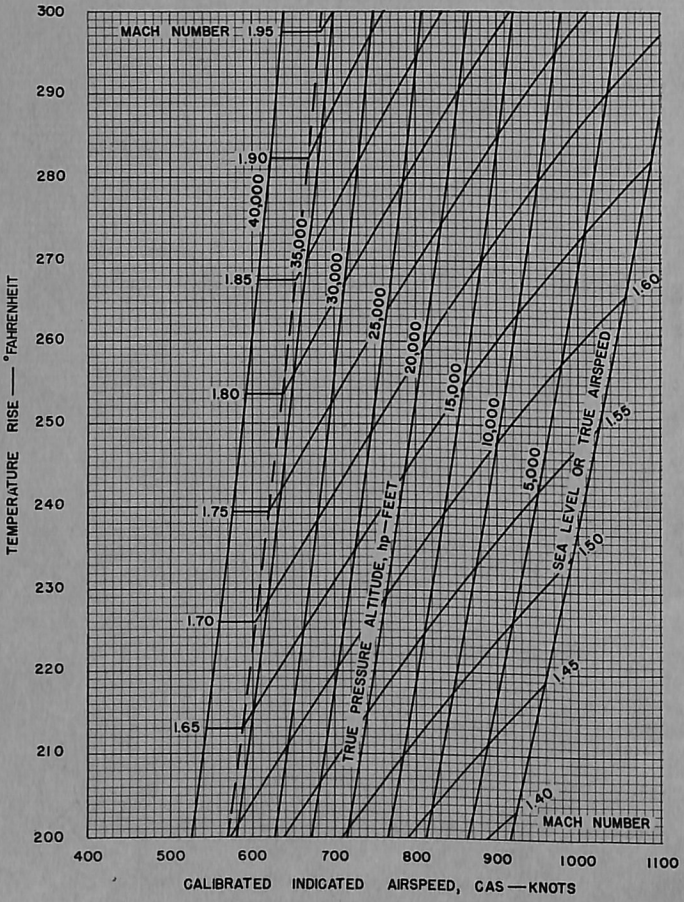


FIG. 8C_D AIR TEMPERATURE RISE DUE TO ADIABATIC COMPRESSION

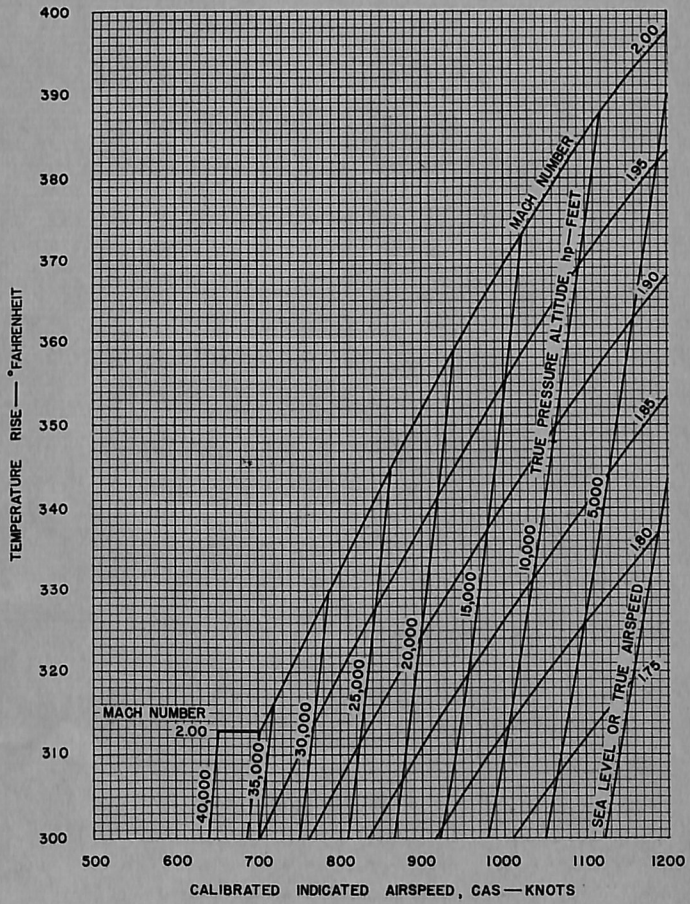


FIG. 8 D_D AIR TEMPERATURE RISE DUE TO ADIABATIC COMPRESSION

FIG. 10A_B EQUIVALENT AIRSPEED VS PRESSURE ALTITUDE AT VARIOUS MACH NUMBERS

FIG. $10B_B$ EQUIVALENT AIRSPEED VS PRESSURE ALTITUDE AT VARIOUS MACH NUMBERS

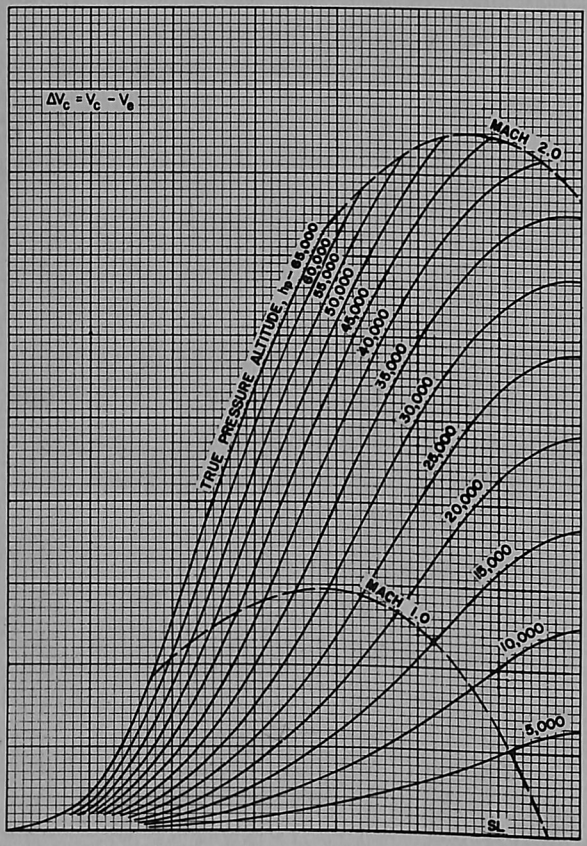


FIG. $11A_B$ COMPRESSIBILITY CORRECTION FOR INDICATED AIRSPEED

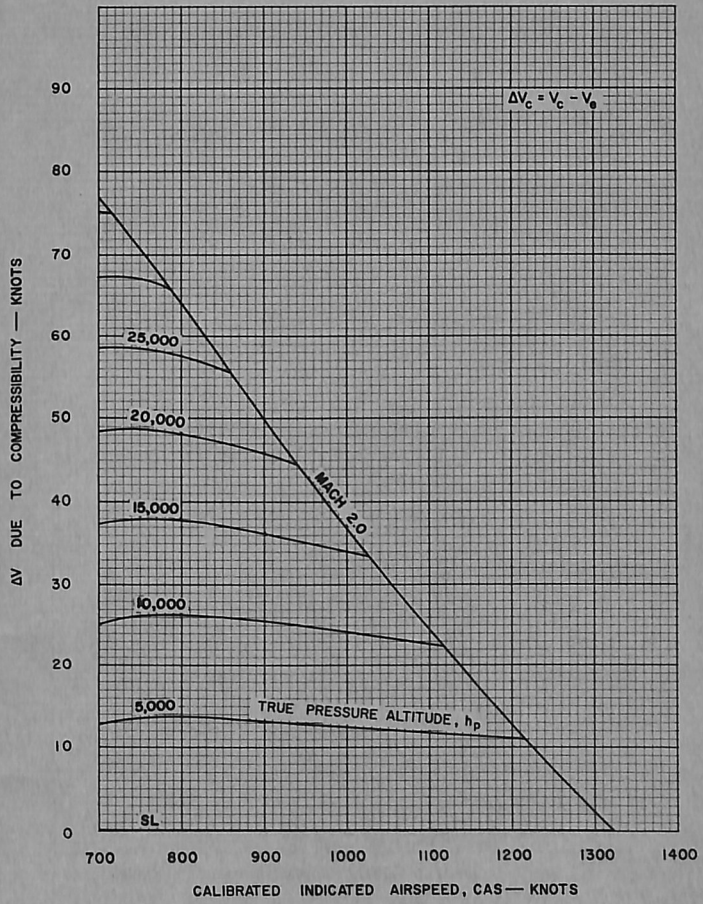


FIG. 11 B_B COMPRESSIBILITY CORRECTION FOR INDICATED AIRSPEED

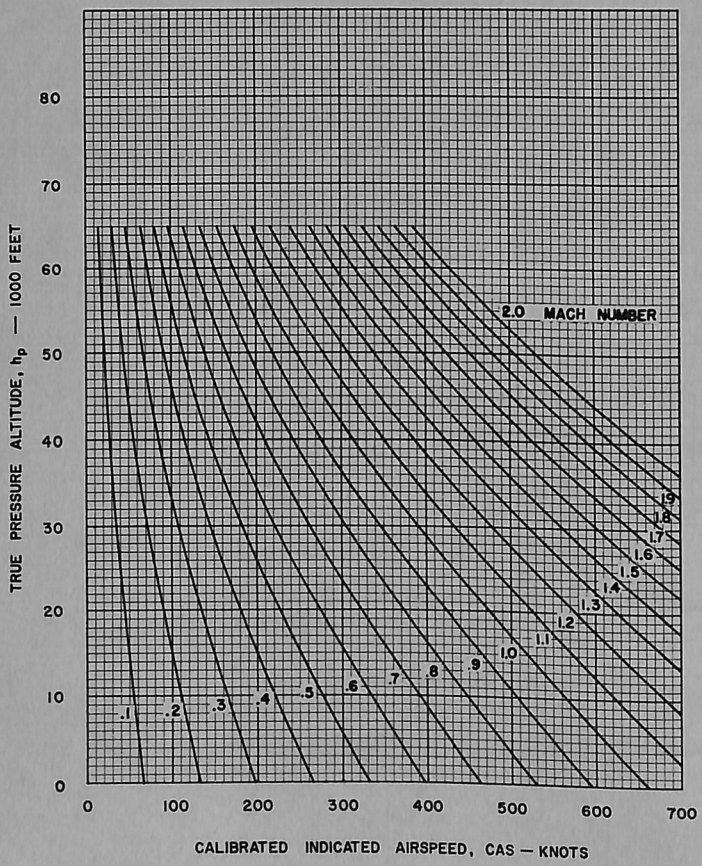


FIG. 12A_B CALIBRATED INDICATED AIRSPEED VS TRUE PRESSURE ALTITUDE AT VARIOUS MACH NUMBERS

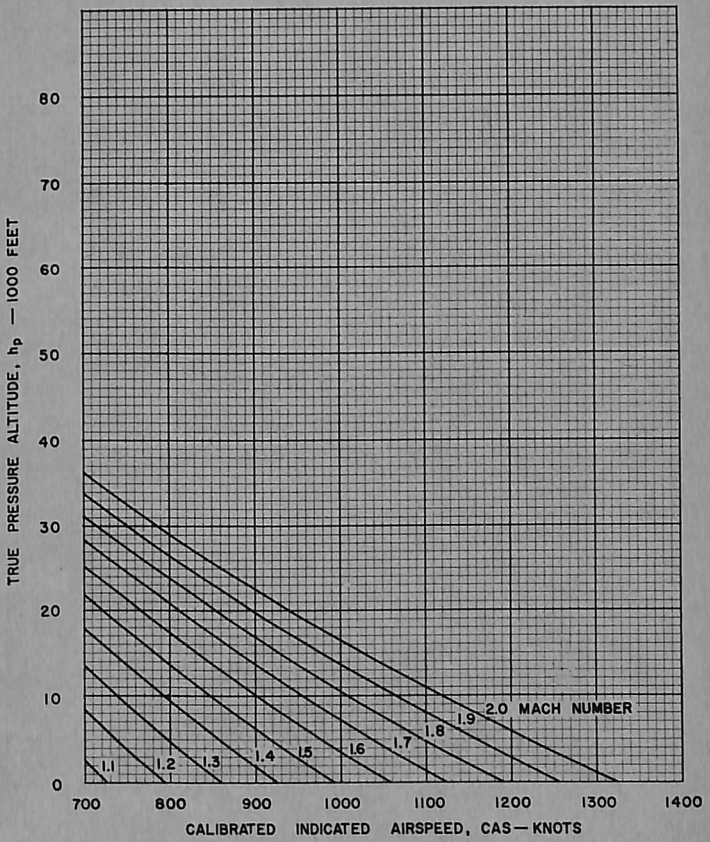


FIG. 12B_B CALIBRATED INDICATED AIRSPEED VS TRUE PRESSURE ALTITUDE AT VARIOUS MACH NUMBERS

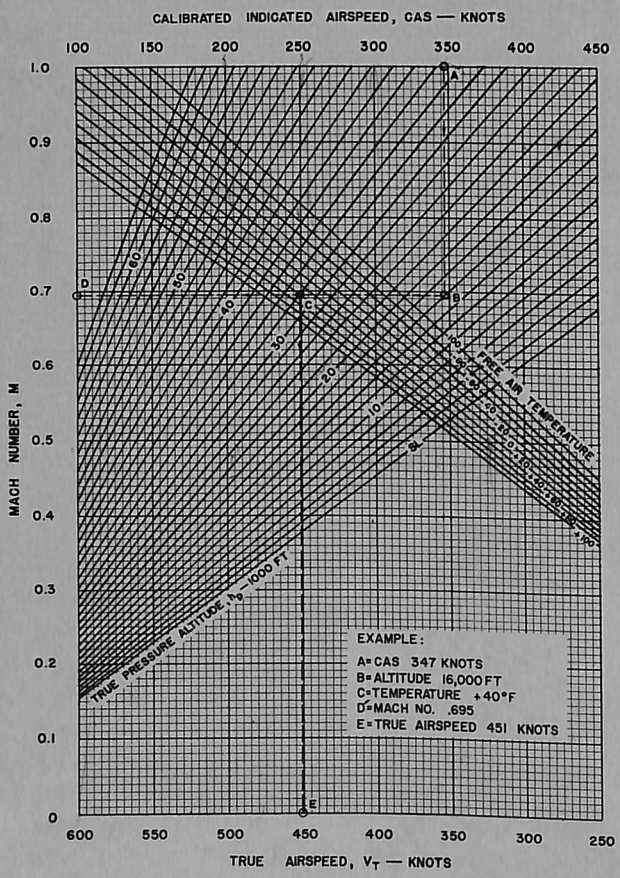


FIG. 13A_E AIRSPEED CONVERSION CHART- FREE AIR TEMPERATURE

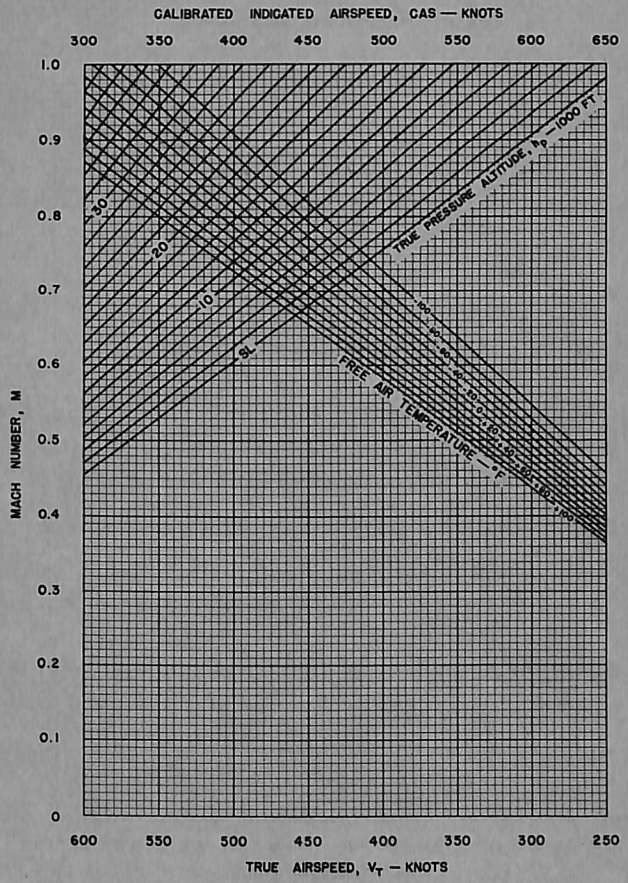


FIG. 13 B_E AIRSPEED CONVERSION CHART FREE AIR TEMPERATURE

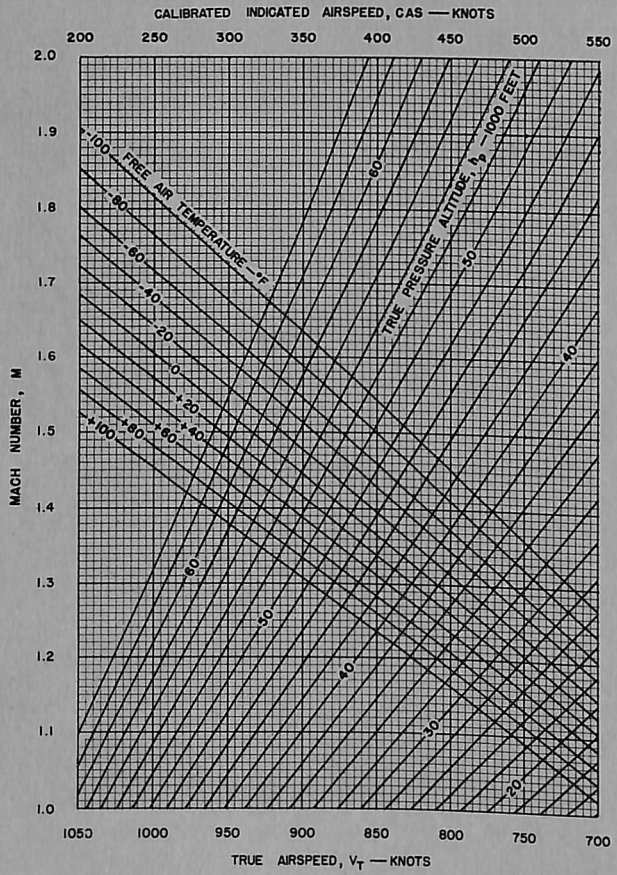


FIG. 13C_E AIRSPEED CONVERSION CHART FREE AIR TEMPERATURE

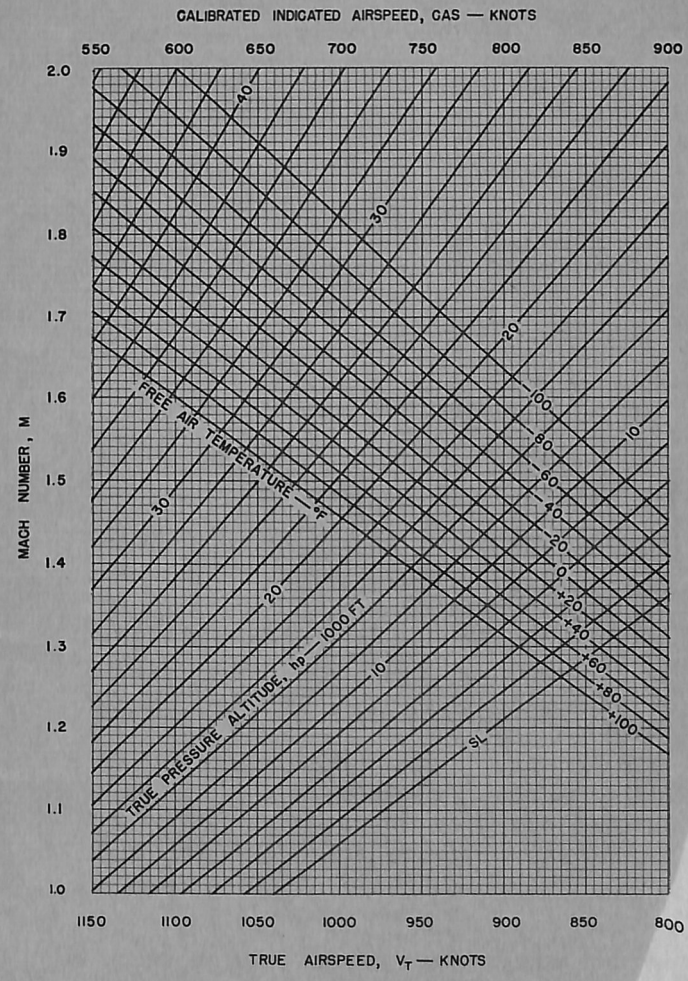


FIG. 13D_E AIRSPEED CONVERSION CHART — FREE AIR TEMPERATURE

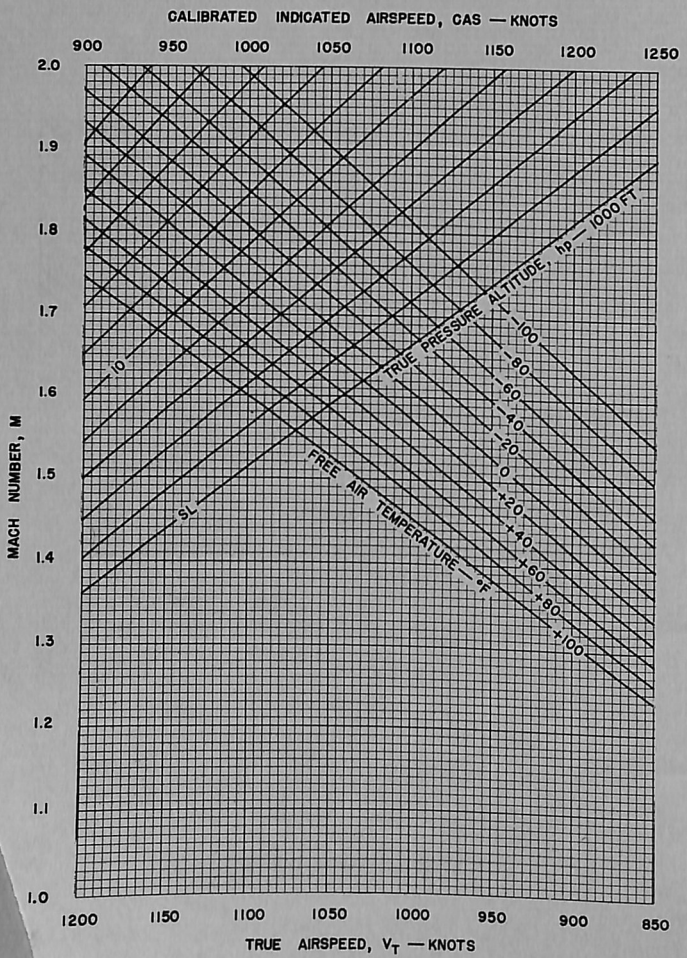


FIG. 13E_E AIRSPEED CONVERSION CHART — FREE AIR TEMPERATURE

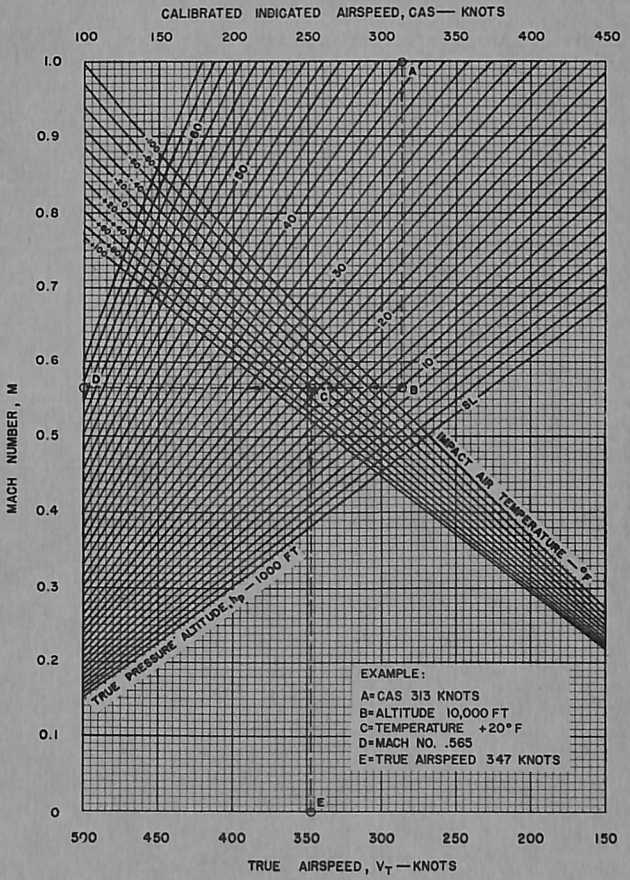


FIG. 14A_E AIRSPEED CONVERSION CHART- IMPACT AIR TEMPERATURE FULL ADIABATIC RISE

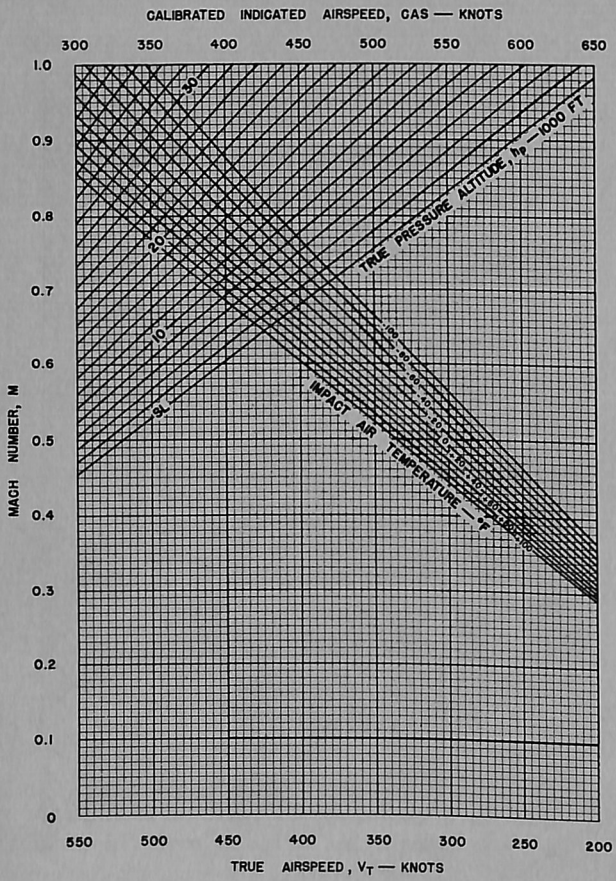


FIG. 14-B_E AIRSPEED CONVERSION CHART— IMPACT AIR TEMPERATURE FULL ADIABATIC RISE

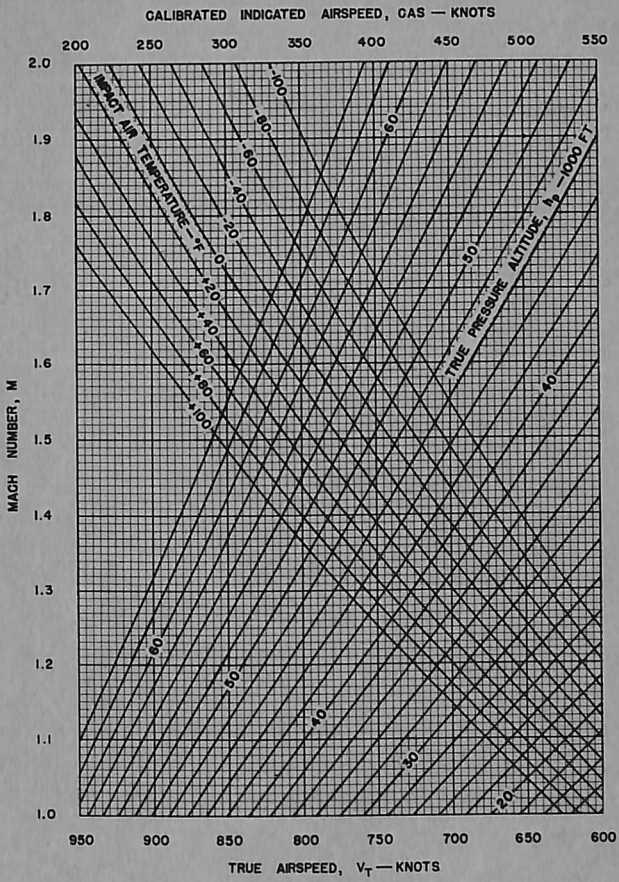


FIG. 14C$_E$ AIRSPEED CONVERSION CHART- IMPACT AIR TEMPERATURE FULL ADIABATIC RISE

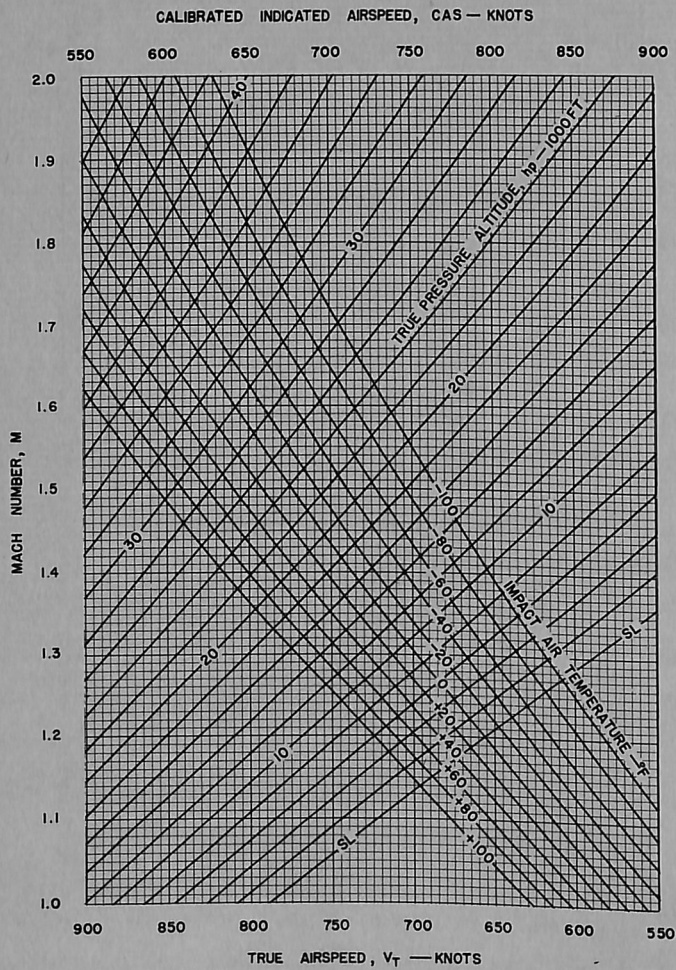


FIG. 14D_E AIRSPEED CONVERSION CHART - IMPACT AIR TEMPERATURE FULL ADIABATIC RISE

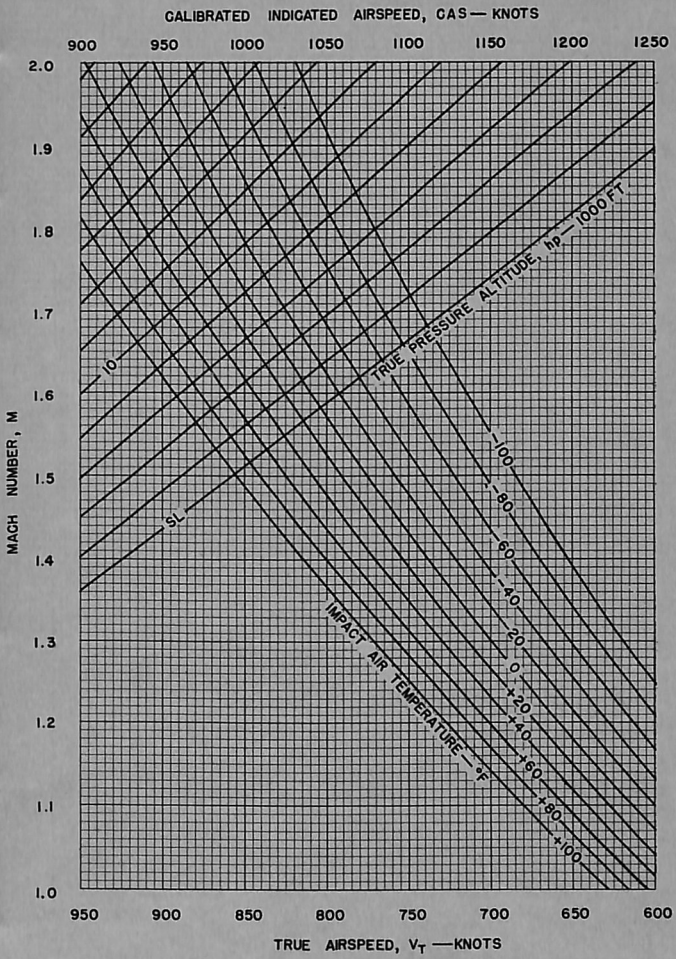


FIG. 14 E_E AIRSPEED CONVERSION CHART— IMPACT AIR TEMPERATURE FULL ADIABATIC RISE

FIG. 15 COMPRESSIBILITY FACTOR CHART

FIG. 16A$_B$ PRESSURE RATIO CONVERSION CHART

FIG. 16 B_B PRESSURE RATIO CONVERSION CHART

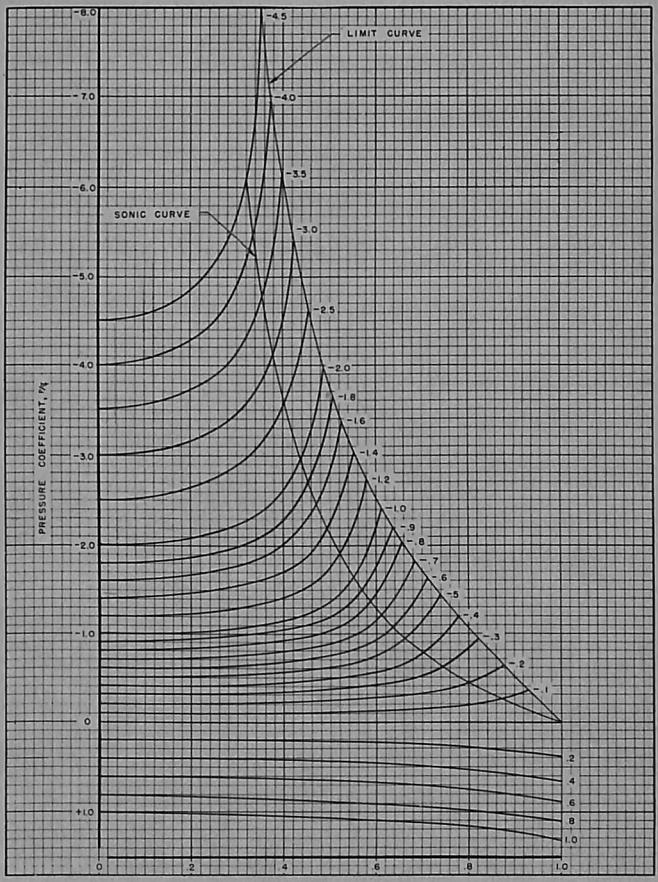
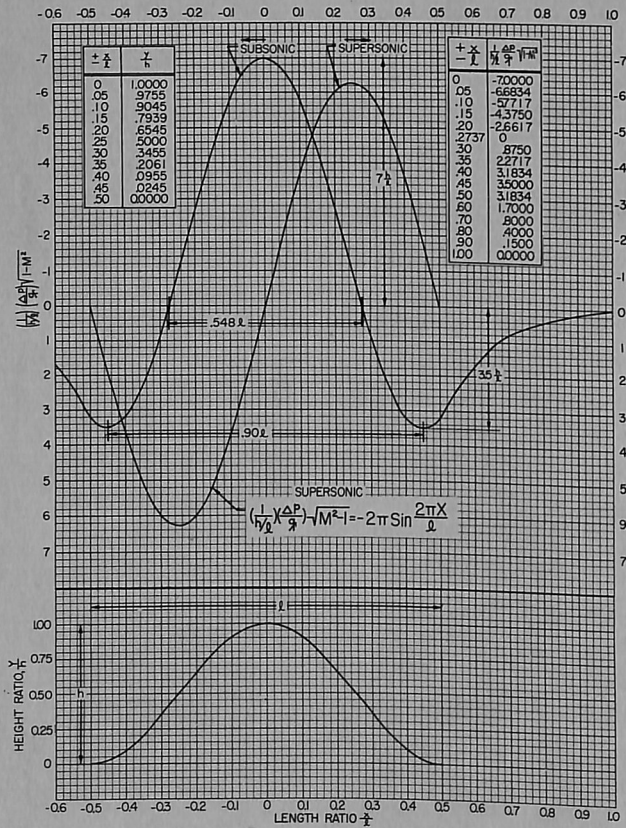


FIG. 17 TENTATIVE VARIATION OF PRESSURE COEFFICIENT WITH MACH NUMBER



$\pm\frac{X}{\ell}$	$\frac{Y}{h}$
0	1.0000
.05	.9755
.10	.9045
.15	.7939
.20	.6545
.25	.5000
.30	.3455
.35	.2061
.40	.0955
.45	.0245
.50	.00000

$\pm\frac{X}{\ell}$	$\frac{1}{h/\ell}\frac{\Delta P}{q}\sqrt{M^2-1}$
0	-7.0000
.05	-6.6834
.10	-5.7717
.15	-4.3750
.20	-2.6617
.2737	0
.30	.8750
.35	2.2717
.40	3.1834
.45	3.5000
.50	3.1834
.60	1.7000
.70	.8000
.80	.4000
.90	.1500
1.00	.00000

FIG. 18 STANDARD BUMP AND PRESSURE DISTRIBUTION

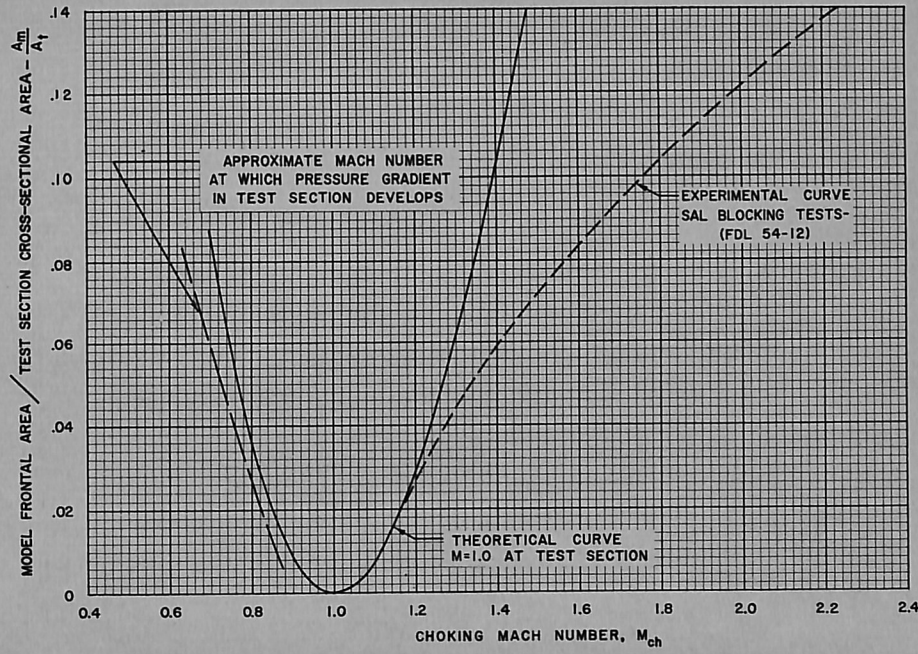


FIG. 19 WIND TUNNEL CHOKING MACH NUMBER

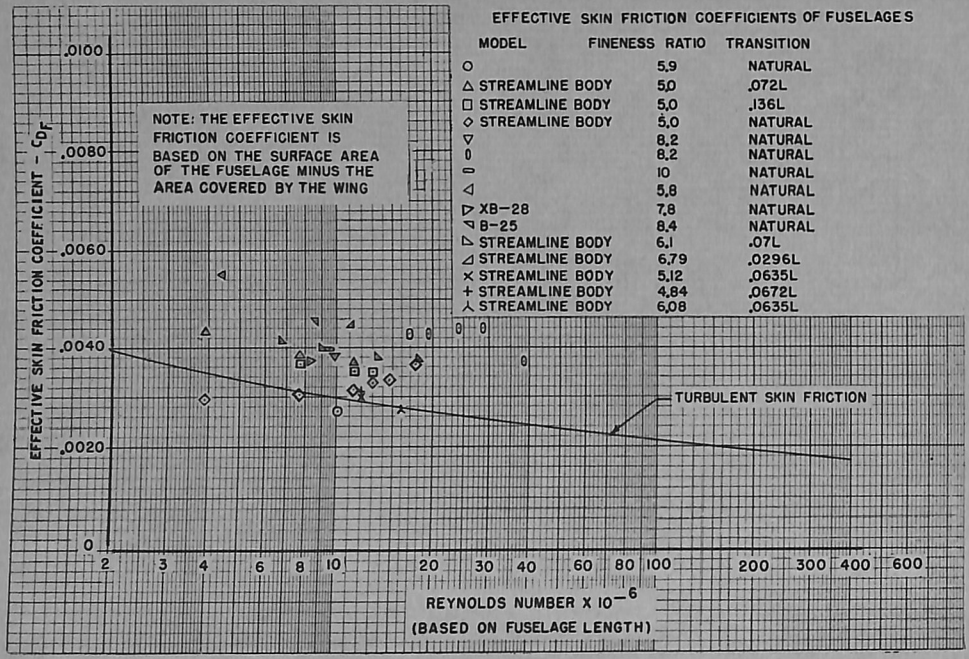

EFFECTIVE SKIN FRICTION COEFFICIENTS OF FUSELAGES
MODEL FINENESS RATIO TRANSITION
○ 5.9 NATURAL
△ STREAMLINE BODY 5.0 .072L
□ STREAMLINE BODY 5.0 .136L
◇ STREAMLINE BODY 5.0 NATURAL
▽ 8.2 NATURAL
▯ 8.2 NATURAL
▭ 10 NATURAL
◁ 5.8 NATURAL
▷ XB-28 7.8 NATURAL
◁ B-25 8.4 NATURAL
▷ STREAMLINE BODY 6.1 .07L
◿ STREAMLINE BODY 6.79 .0296L
× STREAMLINE BODY 5.12 .0635L
+ STREAMLINE BODY 4.84 .0672L
人 STREAMLINE BODY 6.08 .0635L
NOTE: THE EFFECTIVE SKIN FRICTION COEFFICIENT IS BASED ON THE SURFACE AREA OF THE FUSELAGE MINUS THE AREA COVERED BY THE WING
EFFECTIVE SKIN FRICTION COEFFICIENT - C_{D_F}
.0100
.0080
.0060
.0040
.0020
0
TURBULENT SKIN FRICTION
2 3 4 6 8 10 20 30 40 60 80 100 200 300 400 600
REYNOLDS NUMBER X 10^{-6}
(BASED ON FUSELAGE LENGTH)

FIG. 20 EFFECTIVE SKIN FRICTION COEFFICIENTS OF FUSELAGES

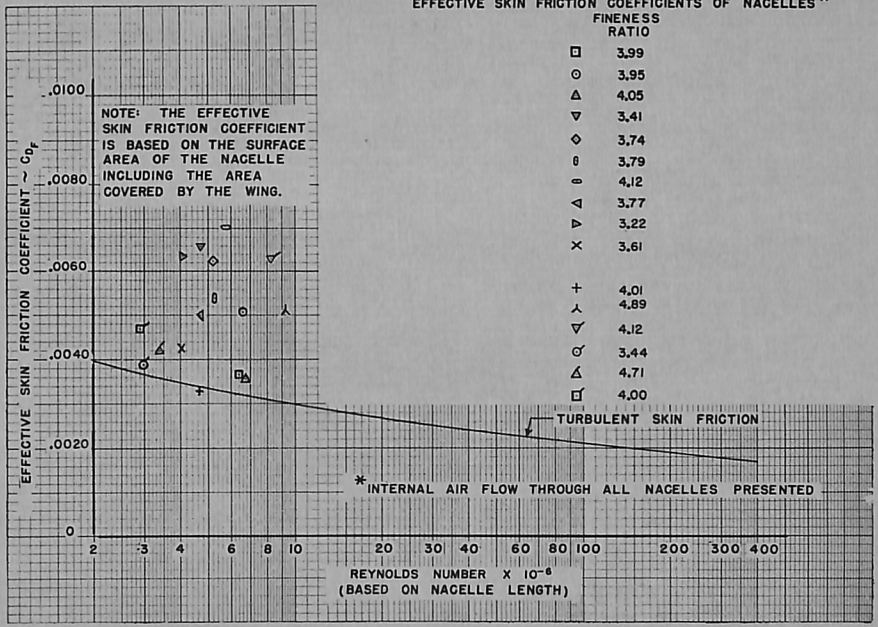


FIG. 21 EFFECTIVE SKIN FRICTION COEFFICIENTS OF NACELLES

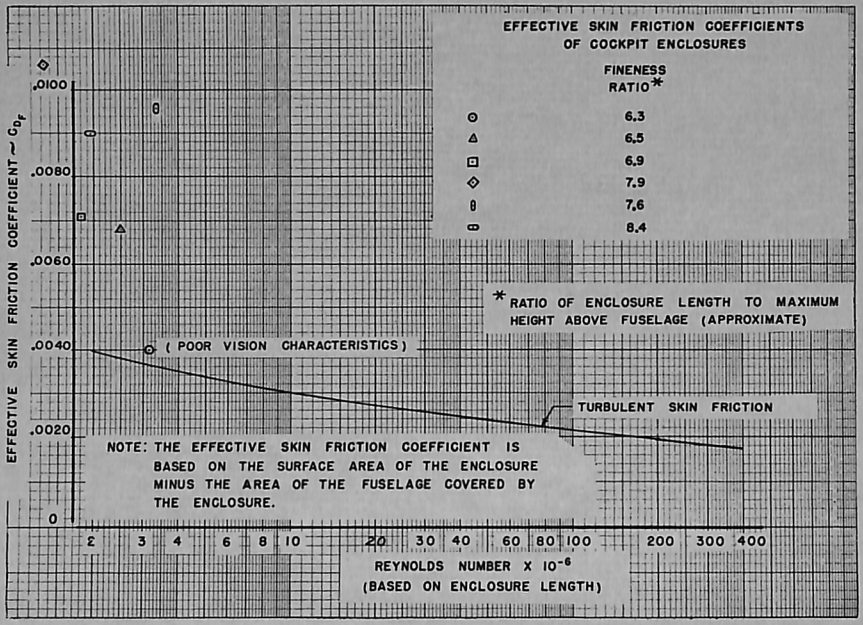

EFFECTIVE SKIN FRICTION COEFFICIENTS OF COCKPIT ENCLOSURES
FINENESS RATIO*
6.3
6.5
6.9
7.9
7.6
8.4
* RATIO OF ENCLOSURE LENGTH TO MAXIMUM HEIGHT ABOVE FUSELAGE (APPROXIMATE)
(POOR VISION CHARACTERISTICS)
TURBULENT SKIN FRICTION
NOTE: THE EFFECTIVE SKIN FRICTION COEFFICIENT IS BASED ON THE SURFACE AREA OF THE ENCLOSURE MINUS THE AREA OF THE FUSELAGE COVERED BY THE ENCLOSURE.
EFFECTIVE SKIN FRICTION COEFFICIENT ~ C_{D_f}
.0100
.0080
.0060
.0040
.0020
0
2 3 4 6 8 10 20 30 40 60 80 100 200 300 400
REYNOLDS NUMBER X 10^{-6}
(BASED ON ENCLOSURE LENGTH)

FIG. 22 EFFECTIVE SKIN FRICTION COEFFICIENTS OF COCKPIT ENCLOSURES

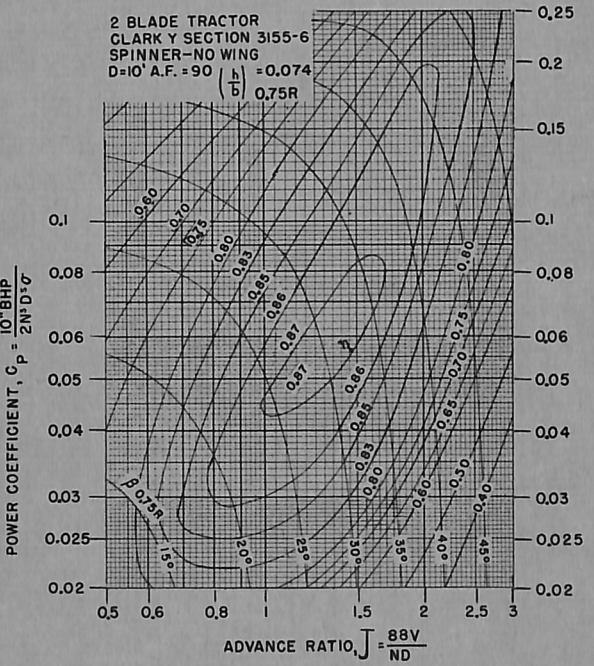


FIG.23 PROPELLER CHARACTERISTICS

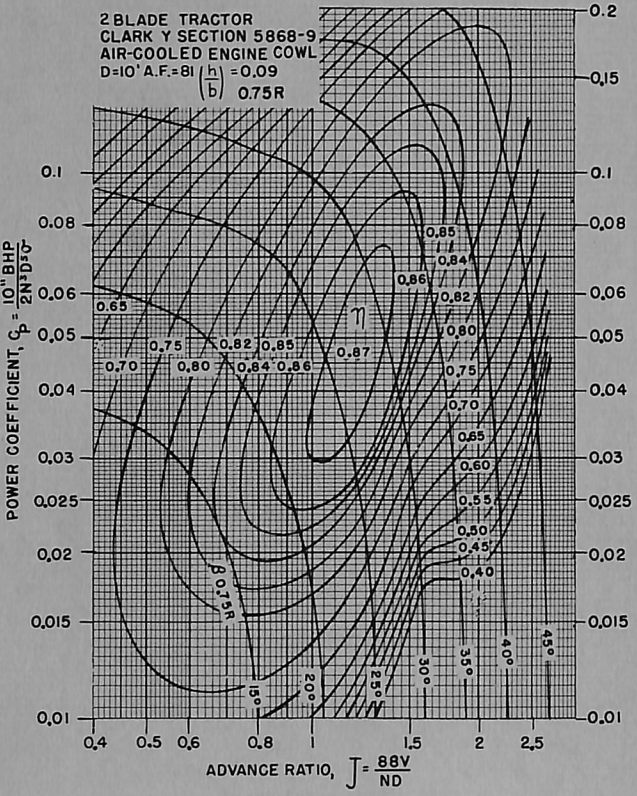


FIG.24 PROPELLER CHARACTERISTICS

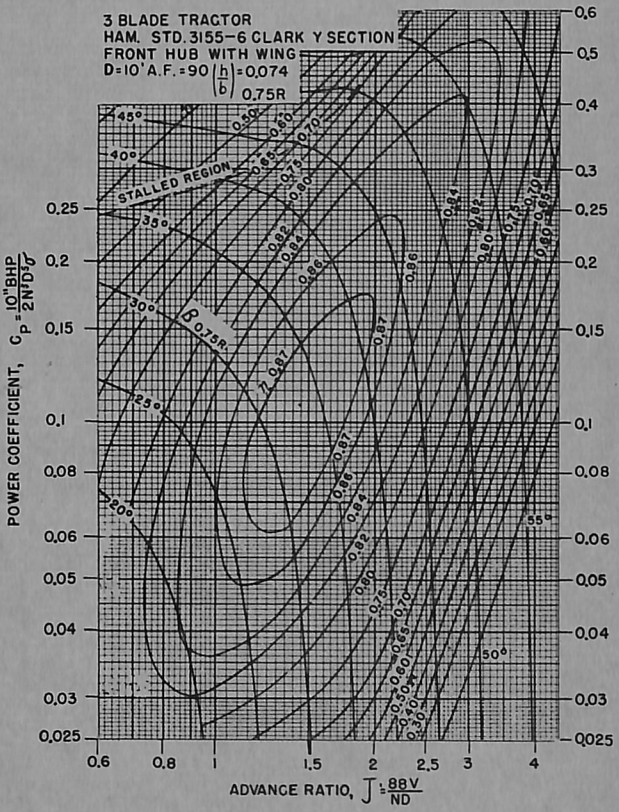


FIG. 25 PROPELLER CHARACTERISTICS

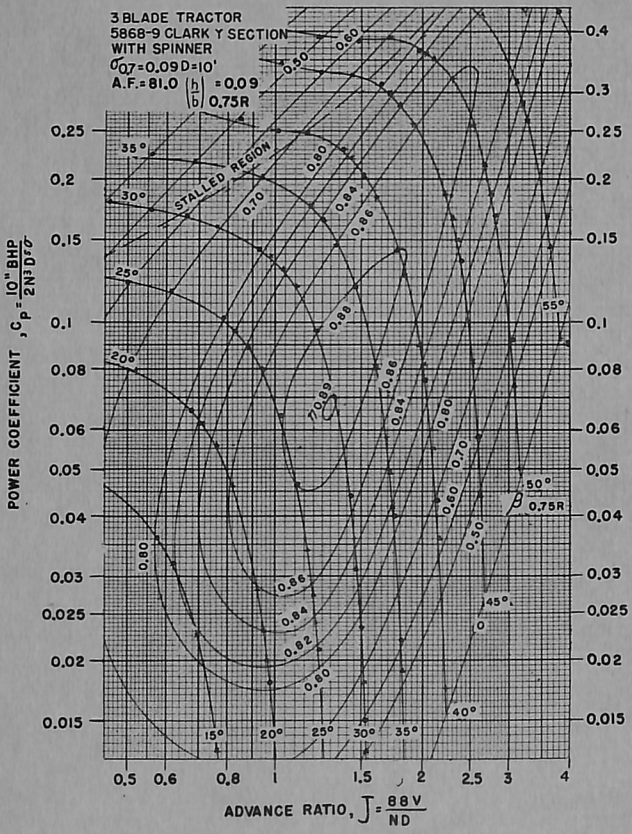


FIG.26 PROPELLER CHARACTERISTICS

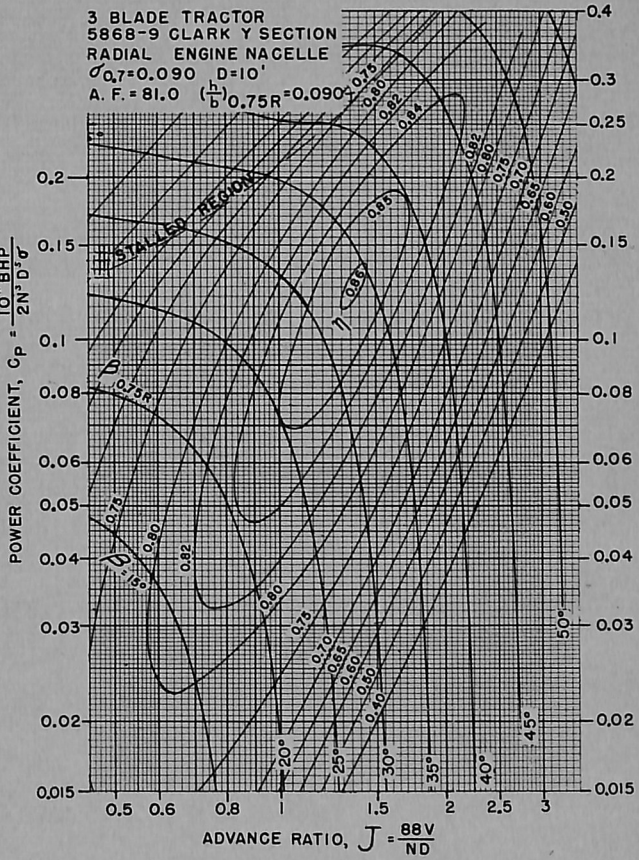


FIG.27 PROPELLER CHARACTERISTICS

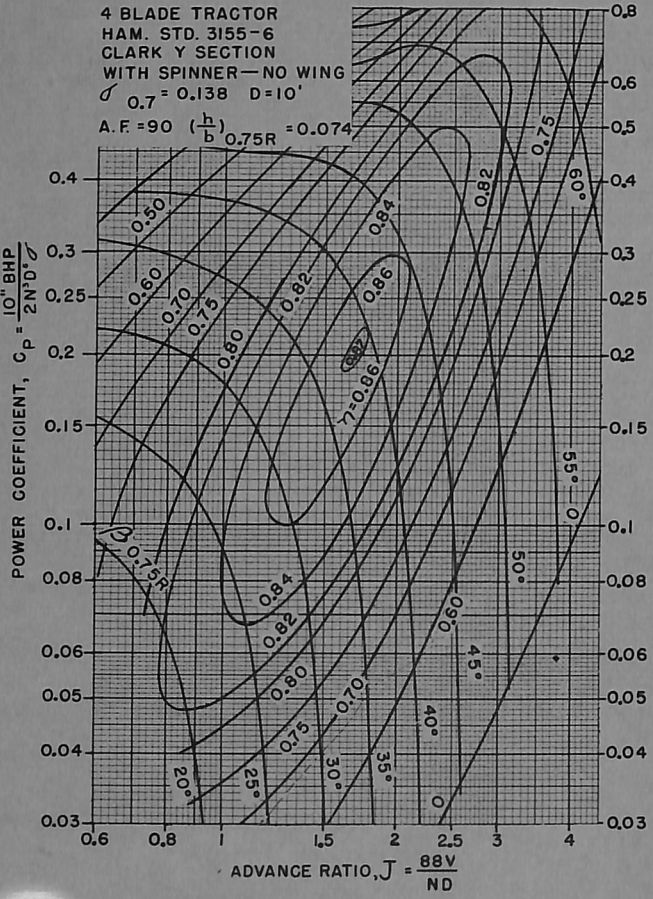


FIG.28 PROPELLER CHARACTERISTICS

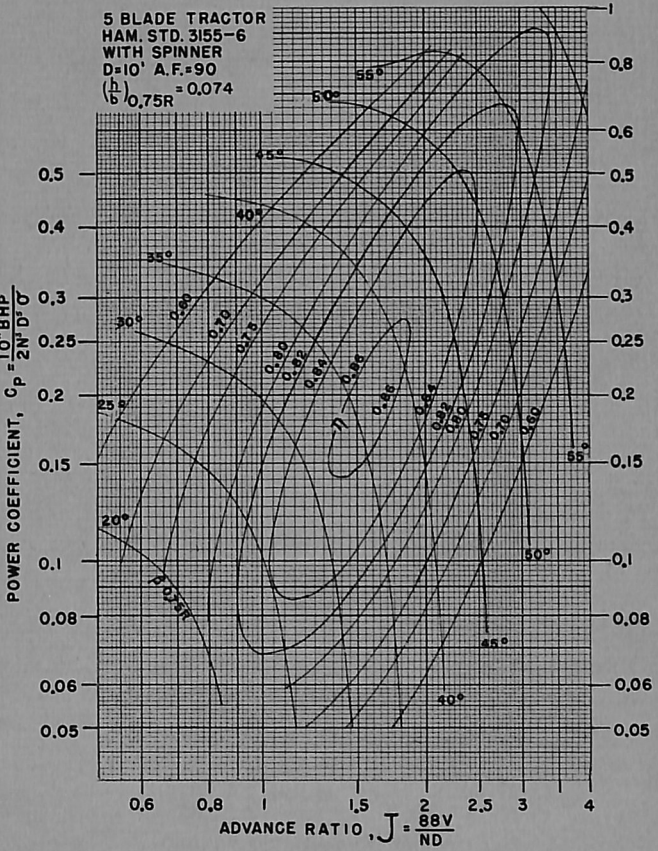


FIG. 29 PROPELLER CHARACTERISTICS

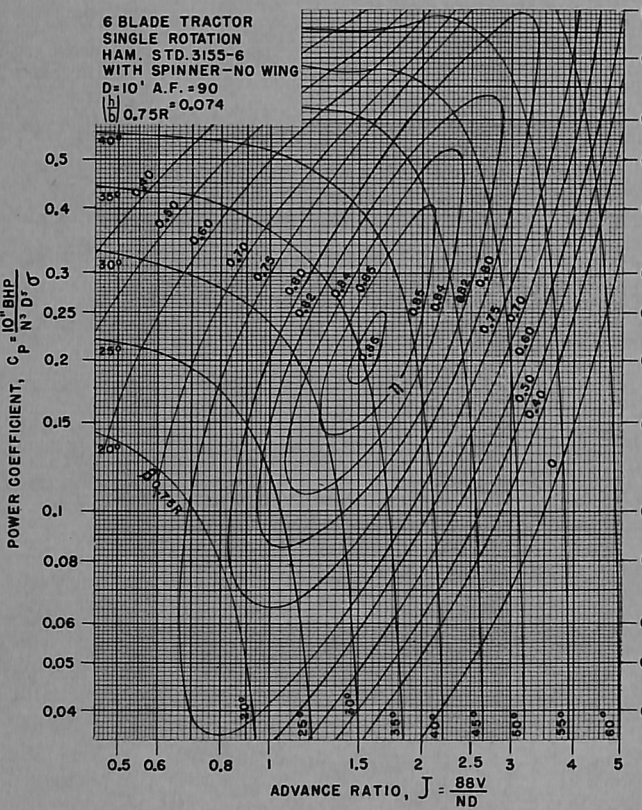


FIG. 30 PROPELLER CHARACTERISTICS

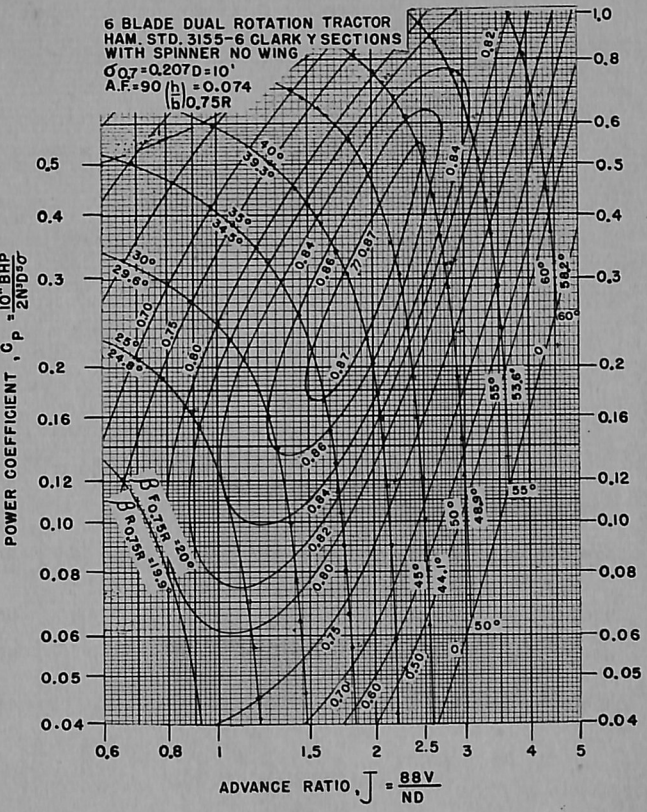


FIG. 31 PROPELLER CHARACTERISTICS

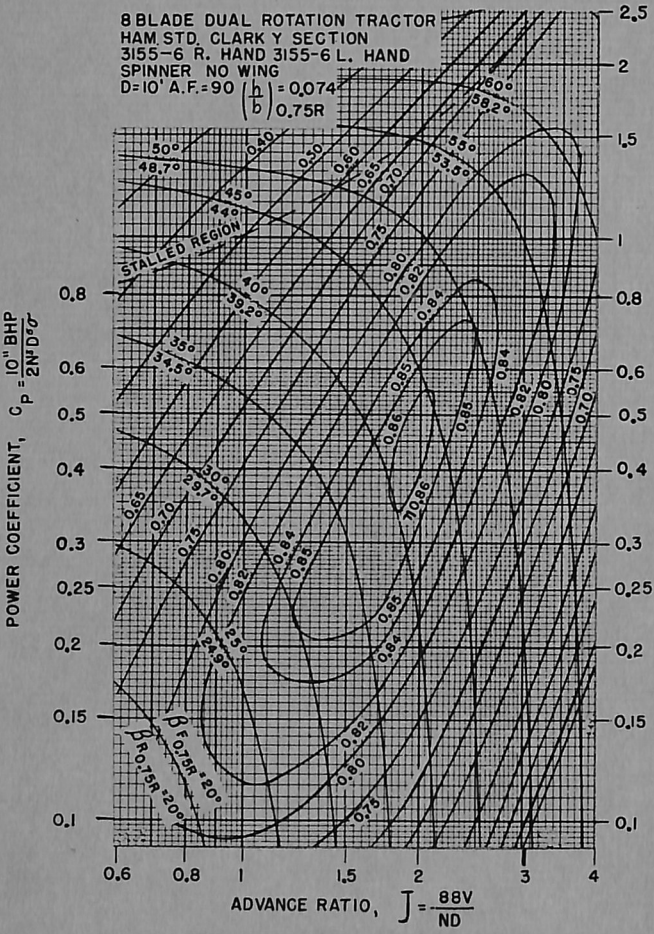

8 BLADE DUAL ROTATION TRACTOR
HAM. STD. CLARK Y SECTION
3155-6 R. HAND 3155-6 L. HAND
SPINNER NO WING
D=10' A.F.=90 (h/b)0.75R = 0.074
STALLED REGION
POWER COEFFICIENT, $C_P = \frac{10^{11} BHP}{2N^3D^5\sigma}$
ADVANCE RATIO, $J = \frac{88V}{ND}$
$\beta_{0.75R} = 20°$
$\beta_{0.75R} = 20°$

FIG 32 PROPELLER CHARACTERISTICS

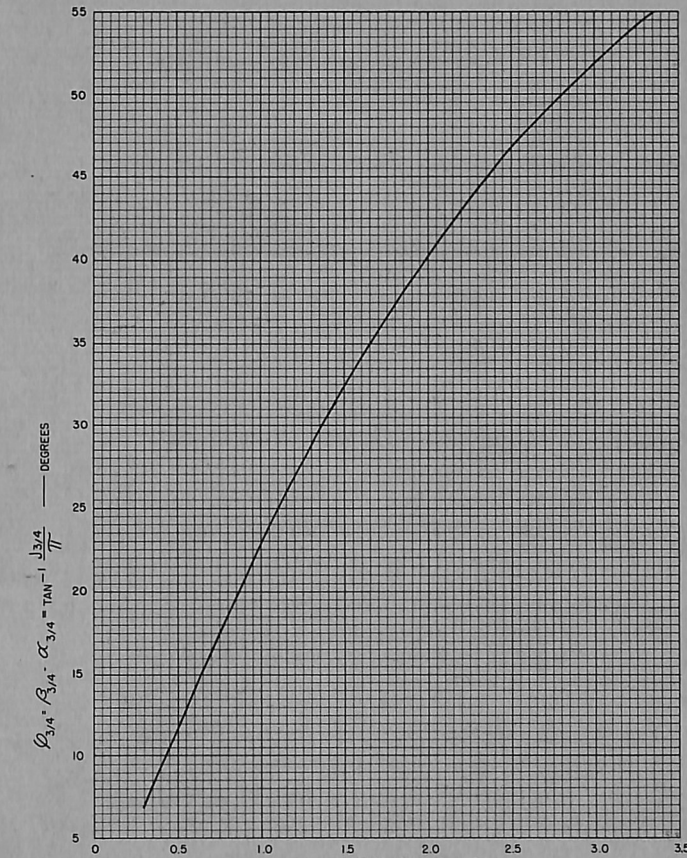


FIG. 33 EFFECTIVE HELIX ANGLE AT 3/4 RADIUS OF PROPELLER BLADE

1. ENTER CHART AT PROPELLER DIAMETER AND PROPELLER RPM (OBTAINED FROM ENGINE RPM AND GEAR RATIO).
2. CROSS TO BASE LINE-1.
3. FOLLOW THICKNESS CORRECTION LINE TO PROPER $(t/b)_{3/4}$ ORDINATE.
4. CROSS TO ALTITUDE BASE LINE-2
5. FOLLOW ALTITUDE CORRECTION LINE TO PROPER ALTITUDE ORDINATE.
6. CROSS TO SPEED BASE LINE-3.
7. FOLLOW VELOCITY CORRECTION LINE TO PROPER VELOCITY ORDINATE.
8. CROSS TO ANGLE BASE LINE-4.
9. FOLLOW ANGLE-OF-ATTACK CORRECTION LINE TO PROPER ANGLE-OF-ATTACK AND OBTAIN EFFECTIVE TIP SPEED.

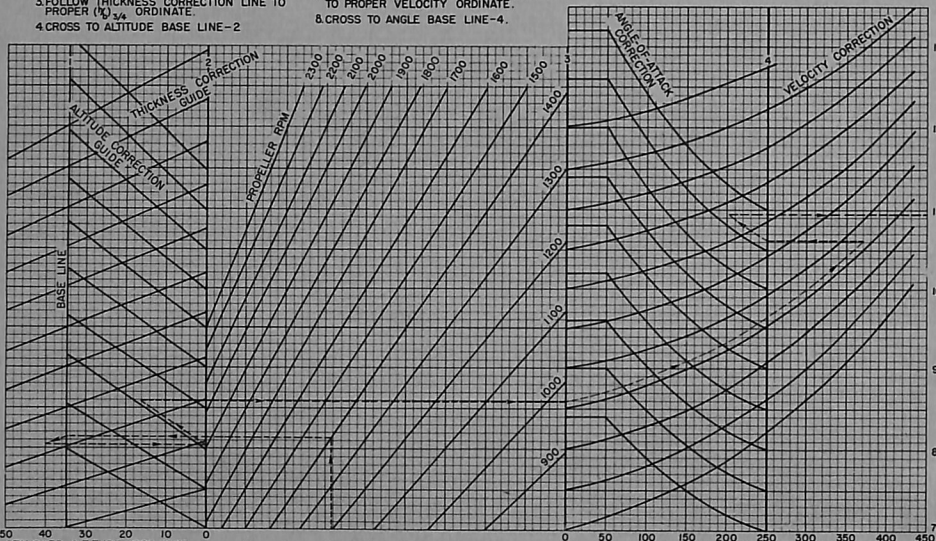


FIG. 34A. COMPOSITE CHART FOR PROPELLER EFFECTIVE TIP SPEED

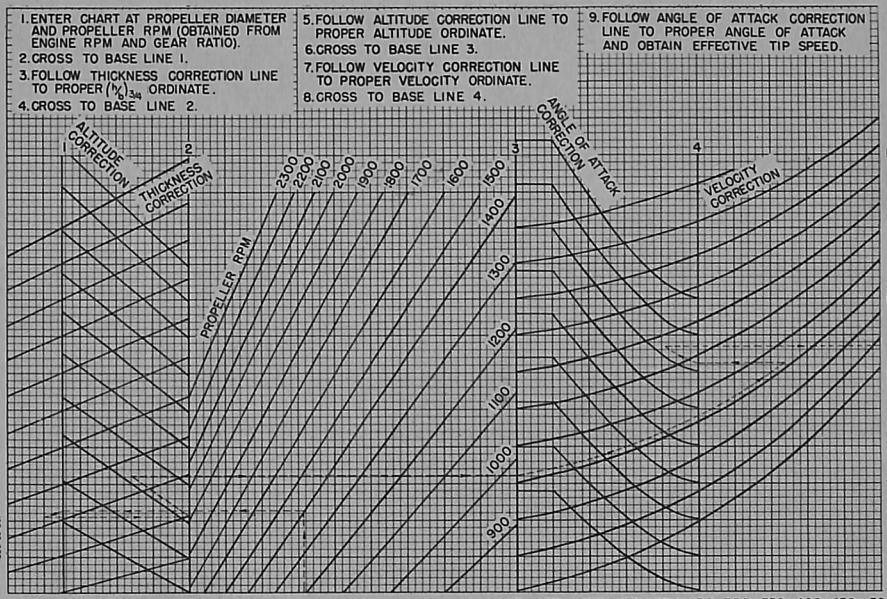

1. ENTER CHART AT PROPELLER DIAMETER AND PROPELLER RPM (OBTAINED FROM ENGINE RPM AND GEAR RATIO).
2. CROSS TO BASE LINE 1.
3. FOLLOW THICKNESS CORRECTION LINE TO PROPER $(t/b)_{3/4}$ ORDINATE.
4. CROSS TO BASE LINE 2.
5. FOLLOW ALTITUDE CORRECTION LINE TO PROPER ALTITUDE ORDINATE.
6. CROSS TO BASE LINE 3.
7. FOLLOW VELOCITY CORRECTION LINE TO PROPER VELOCITY ORDINATE.
8. CROSS TO BASE LINE 4.
9. FOLLOW ANGLE OF ATTACK CORRECTION LINE TO PROPER ANGLE OF ATTACK AND OBTAIN EFFECTIVE TIP SPEED.
ALTITUDE CORRECTION
THICKNESS CORRECTION
PROPELLER RPM
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
ANGLE OF ATTACK CORRECTION
VELOCITY CORRECTION
1300
1200
1100
1000
900
800
700
EFFECTIVE TIP SPEED - FT/SEC.
50 40 30 20 10 0
STANDARD ALTITUDE-1000 FEET
8 9 10 11 12 13 14 15 16 17
PROPELLER DIAMETER-FEET
0 50 100 150 200 250 300 350 400 450 500
TRUE AIRSPEED, V_T - MPH
0.06 0.07 0.08 0.09 0.10 0.11
MAX THICKNESS OF BLADE SECTION AT 3/4 RADIUS / CHORD LENGTH OF BLADE SECTION AT 3/4 RADIUS = $(t/b)_{3/4}$
10 5 0
ANGLE OF ATTACK AT 3/4 RADIUS, $\alpha_{3/4} = \beta_{3/4} - \varphi_{3/4}$

FIG. 34B COMPOSITE CHART FOR PROPELLER EFFECTIVE TIP SPEED

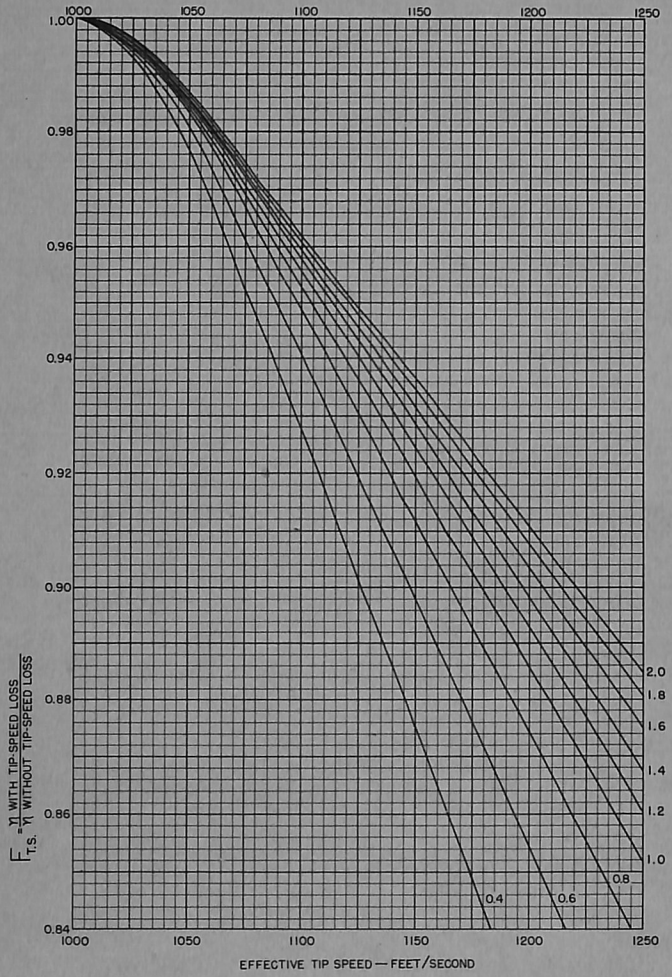


FIG. 35 LOSS IN PROPULSIVE EFFICIENCY DUE TO EXCESSIVE TIP SPEED

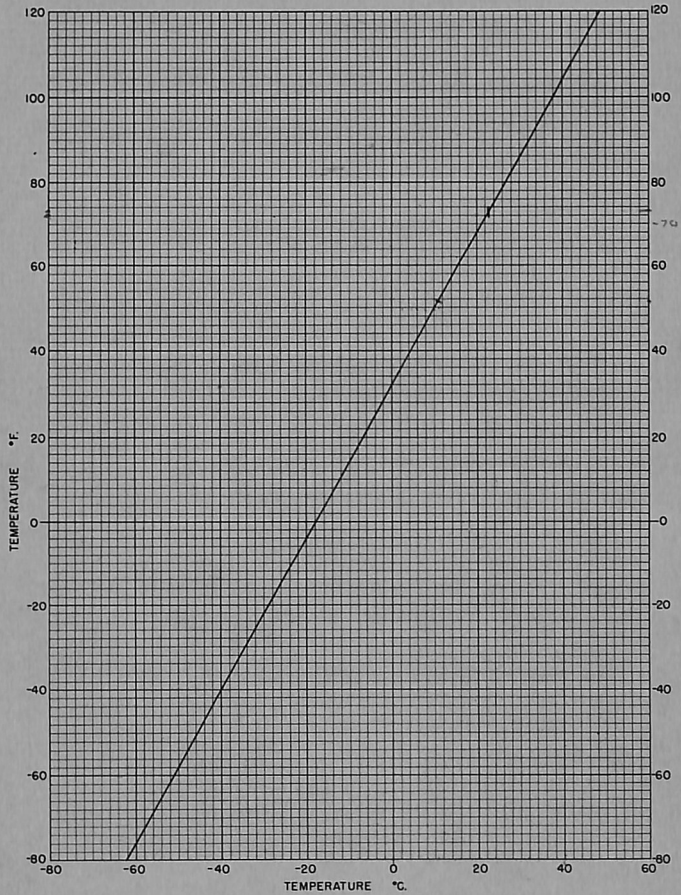


FIG. 36 TEMPERATURE CONVERSION CHART

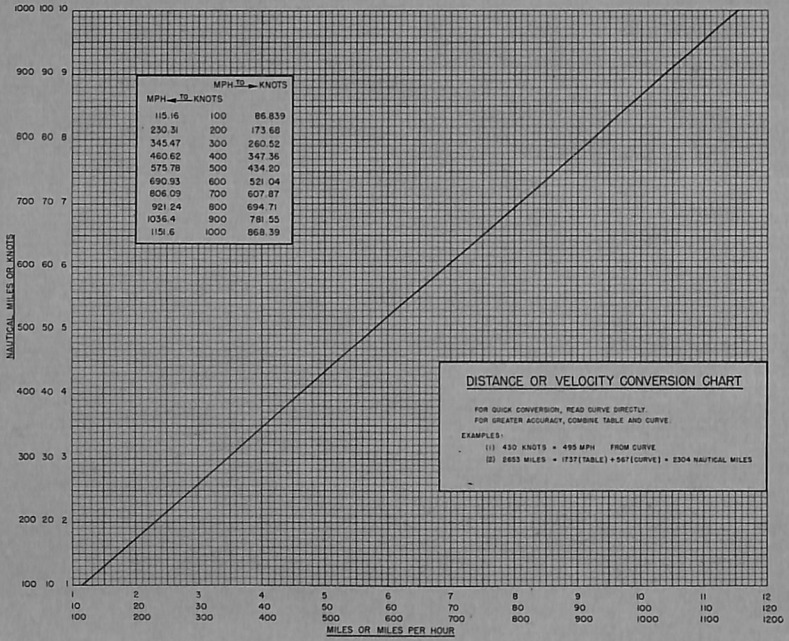


FIG.37 DISTANCE OR VELOCITY CONVERSION CHART

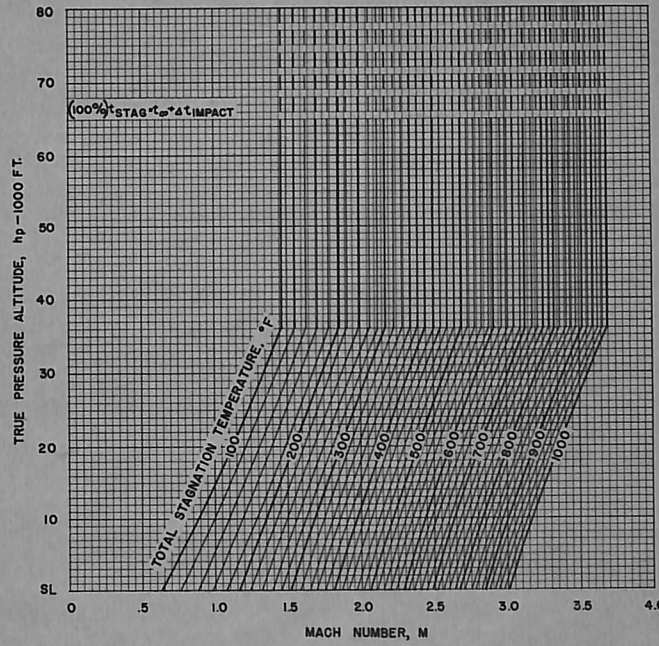


FIG. 38 TOTAL STAGNATION TEMPERATURE

NOTES

Given: M^2, H_p

$V_T^2 = \left(\frac{g}{M^2}\right) 29.5 \frac{M^2}{\sigma}$ (Std Condition)

$V_e^2 = \sigma V_T^2 = 29.5 \left(\frac{g}{M^2}\right) M^2$